



A&P TECHNICIAN AIRFRAME

TEST GUIDE WITH ORAL AND
PRACTICAL STUDY GUIDE



Jeppesen Sanderson Inc.

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PREFACE

Thank you for purchasing this *Aviation Mechanic Airframe Airmen Knowledge Test Guide*. This Test Guide will help you understand the answers to the test questions so you can take the FAA Computerized Knowledge, Oral, and Practical exams with confidence. It includes FAA Aviation Mechanic Airframe Knowledge test questions, sample oral test questions, and samples of typical practical projects that an FAA Designated Examiner may assign during the Practical exam. For the Computerized Knowledge Exam portion of the *Test Guide*, the correct answers are included with explanations, along with study references. Explanations of why the other choices are wrong have been included where appropriate. Questions are organized by topic with explanations conveniently located following each question. Figures identical to those on the FAA test are included.

The material for the Airframe Mechanic Oral and Practical exams is included in Appendix B of the *Test Guide*. Since the Oral and Practical exam questions are not public domain information, our questions may not reflect the exact questions that you will be asked during your test. However, we feel confident that if you can answer the sample oral questions and perform the practical projects that we present in this *Test Guide*, you should have no difficulty passing your FAA exams. Our sample questions and projects reflect the most current information that the FAA requires Designated Mechanic Examiners to use during testing. Please note that this Test Guide is intended to be a supplement to your instructor-led maintenance training, not a stand-alone learning tool.

Refer to the diagram of the Jeppesen Integrated Training System on the following pages to see how the various training materials complement each other. This diagram shows the integrated features of the Textbooks, Workbooks and Test Guides in detail.

If you would like to find out more about career opportunities in aviation maintenance and how you can get started, you can email your specific career and/or training questions to:
AMT@jeppesen.com

Also use this address for comments/questions regarding technical content of Jeppesen maintenance materials.

UPDATES OF FAA QUESTIONS — You can obtain free updates for the FAA questions in this *Test Guide* by visiting Jeppesen's website. These updates are generally valid within one year of book publication. If you are using an older test guide, the web site may not update all the questions that have changed since the book was printed.

To find update questions, go to www.jeppesen.com, click Online Publications and then click *Jeppesen Product Updates* and *FAA Test Prep Updates*. Due to improvements and ongoing reorganization of the website, the exact location of the updates is subject to change.

JEPPESEN INTEGRATED TRAINING SYSTEM

Test Guide—presents written test questions, along with the answers, explanations, and references to the applicable *textbook* to provide an integrated learning solution.

Test Guide questions are grouped into the same chapter and subsection as the corresponding *textbook* for easy reference.

Workbook—used to reinforce learning concepts taught in the corresponding *textbook*.

WORKBOOK

Excerpt from Chapter 3 Section B, Turbine Engines

3-4

SECTION B OPERATING PRINCIPLES

1. The operating cycle of events used by turbine engines is known as the _____ cycle.
2. The Brayton cycle is known as a **constant** _____ (pressure or volume) cycle.
3. A large turbine engine can operate with a thermal efficiency as high as _____ percent.
4. Warm air is _____ (more or less) dense than cool air.
5. As the temperature of the air at the intake of a turbine engine increases, the amount of thrust produced will _____ (increase or decrease).
6. To counteract the effects of high intake temperatures, some engines use a _____ thrust augmentation system.
7. Net thrust of a turbine engine will _____ (increase or decrease) with an increase in altitude.
8. The net effect of airspeed on thrust is that the thrust _____ (will or will not) increase as airspeed increases.
9. The speed at which the ram air pressure rise cancels the pressure drop inside the inlet duct is known as the

Workbook questions are grouped into the same chapter and subsection as the corresponding *textbook* for easy reference.

Excerpt from Chapter 3 Section B, Turbine Engines

Turbine Engines Test Guide

3-13

3-58. B02
The stators in the turbine section of a gas turbine engine

- A — increase the velocity of the gas flow.
- B — decrease the velocity of the gas flow.
- C — increase the pressure of the gas flow.

3-59. Answer A. JSPT 3-25 (AC 65-12A)
The fixed stator vanes in the turbine section of a turbine engine are located ahead of the turbine stators and act as nozzles to increase gas flow velocity and decrease pressure. Answer (B) is incorrect because stator vanes increase gas flow velocity and decrease pressure. Answer (C) is incorrect because stator vanes increase gas flow velocity and decrease pressure.

3-59. B03
The Brayton cycle is known as the constant

- A — pressure cycle.
- B — temperature cycle.
- C — mass cycle.

3-59. Answer A. JSPT 3-38 (AC 65-12A)
The Brayton cycle describes the combustion process in a turbine engine. This process is also known as the constant pressure cycle because the pressure across the combustion section in a turbine engine remains relatively constant. Answers (B) and (C) are incorrect because temperature and mass flow vary substantially in a turbine engine.

3-61. B02
The compressor stators in a gas turbine engine act as diffusers to

- A — decrease the velocity of the gas flow.
- B — increase the velocity of the gas flow.

Test Guide Reference System

In this example, you would find the answer to question 3-59 by referring to page 3-38 of the *Jeppesen Powerplant textbook* (JSPT 3-38).

- A — number of compressor stages.
- B — rotor diameter.
- C — air inlet velocity.

3-62. Answer A. JSPT 3-14 (AC 65-12A)
The primary factor in determining the pressure ratio in an axial-flow compressor is the number of stages within the compressor. Additional factors that affect pressure ratio include overall compressor efficiency and the pressure ratio produced by each stage. Answer (B) is incorrect because changing the rotor diameter affects mass flow, not pressure. Answer (C) is incorrect because changing the air inlet velocity affects mass flow, not pressure.

TEXTBOOK

Excerpt from Chapter 3 Section B, Turbine Engines

3-38

SECTION B

ENERGY TRANSFORMATION CYCLE

The energy transformation cycle in a gas turbine engine is known as the **Brayton cycle** or **constant pressure cycle**. The Brayton cycle is similar to the four-stroke cycle in that an intake, compression, combustion, and exhaust event occur in both cycles. However, unlike a piston engine, all four events happen simultaneously and continuously in a gas turbine engine. This gives the gas turbine engine the unique ability to produce power continuously. There is a downside, however, in that a gas turbine engine must burn a great deal of fuel to support the continuous production of power. [Figure 3-67]

OPERATING PRINCIPLES

ENERGY TRANSFORMATION

Like the piston engine, a gas turbine engine is a form of heat engine that converts the chemical energy of fuel into heat energy. Once converted, the heat energy causes an increase in gas pressure that is converted into kinetic energy in the form of a high velocity stream of air. The kinetic energy is then converted into mechanical energy when the expanding gases rotate a series of turbine wheels that drive a compressor and accessories. In the case of turboprop or turboshaft engines, the expanding gases may also drive a second power turbine which drives a propeller or gearbox.

ENERGY TRANSFORMATION CYCLE

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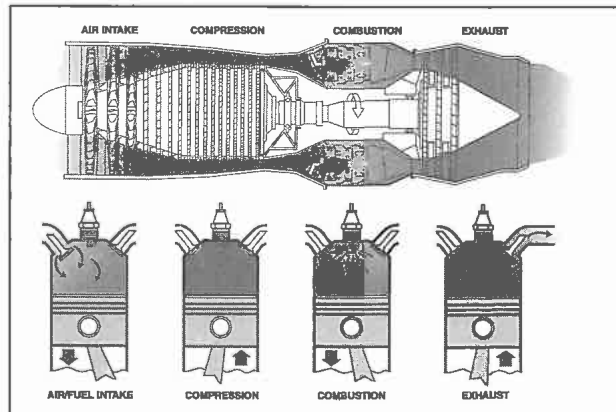


Figure 3-67. In a gas turbine engine, air is taken in through an air inlet, compressed in the compressor, mixed with fuel and ignited in the combustors, then exhausted through the turbines and exhaust nozzle. This allows a gas turbine engine to perform the same functions as a cylinder and piston in a reciprocating engine except that, in a turbine engine, the events happen continuously.

TEST GUIDE WITH ORAL AND PRACTICAL STUDY GUIDE

Excerpts from Chapter 3 Section B, Turbine Engines

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Oral questions are grouped into the same chapter as the corresponding textbook. For easy reference they include the answers, and references to the textbook by chapter and page number.

Oral & Practical Study Guide—provides an overview of the O&P process, along with sample questions and exercises you will be assigned and required to perform.

Practical exercises are grouped into the same chapter as the corresponding Textbook. They include the given or variables for the exercise along with the required performance standard.

Appendix B Oral Test Questions

B3-1

Chapter 3 — Turbine Engines

Q #	Question and Answer	Page Reference
1	Explain the main difference and advantage of turbofan over turbojet engines. <i>Answer — A turbofan engine uses a fan to bypass some air around the engine core and to provide thrust. The advantage is that this provides additional thrust without increasing fuel flow.</i>	JSPT 3-5
2	Name the major components in a gas turbine engine. <i>Answer — Air inlet, compressor section, combustion section, turbine section, exhaust section, gearbox and accessory section</i>	JSPT 3-8
3	Explain the main difference of the energy transformation cycle in a gas turbine engine compared to a piston engine? <i>Answer — All four energy events, intake, compression, combustion, and exhaust, occur simultaneously and continuously in a gas turbine engine versus consecutively as in a piston engine.</i>	JSPT 3-38
4	Name the two types of compressors commonly used in turbine engines. <i>Answer — Axial and centrifugal flow compressors</i>	JSPT 3-13
5	Name two different methods for attaching turbine engine rotor blades to the rotor disks. <i>Answer —</i>	JSPT 3-16

B3-4

Chapter 3 — Turbine Engines

Appendix B Practical Test

Project #	Project Description	Level
1	Project: Identify major components of turbine engines. <i>Given:</i> Unlabeled drawings of turbojet or turbofan engines and a list of component nomenclatures. <i>Performance Standard:</i> The applicant will label major components of turbine engines.	2
2	Project: Identify characteristics of different turbine compressors. <i>Given:</i> Unlabeled drawings of various types of compressors and a list of characteristics. <i>Performance Standard:</i> The applicant will label the drawings of compressors with characteristics.	2
3	Project: Identify airflow direction and pressure changes in turbojet or turbofan engines. <i>Given:</i> Unlabeled drawings of turbojet or turbofan engines. <i>Performance Standard:</i> The applicant will label, with arrows, the direction of airflow through a turbojet or turbofan engine, and note any change of air pressure between sections.	2

Refers back to Jeppesen training system.

Subject matter knowledge codes—can be used to reference Jeppesen's training system.

Using "B03" as an example, to find information on the installation of turbine engines, look up the subject "turbine engine installation" in the Jeppesen index and it will refer you to the appropriate chapter and page in the Powerplant textbook.

SUBJECT MATTER KNOWLEDGE CODES

APPENDIX

A

SUBJECT MATTER KNOWLEDGE CODES

LIST OF REFERENCE MATERIALS AND SUBJECT MATTER KNOWLEDGE CODES

The publications listed in the following pages contain study material you need to be familiar with when preparing for aviation mechanic knowledge tests. All of these publications can be purchased through U.S. Government bookstores, commercial aviation supply houses, or industry organizations. The latest revision of the latest references should be requested. Additional study material is also available through these sources that may be helpful in preparing for aviation mechanic knowledge tests. All publications listed would be excellent for a mechanic to have in a personal reference library.

The following abbreviations are used to identify the reference(s) associated with the subject matter.

AVIATION MECHANIC POWERPLANT ABBREVIATIONS AND REFERENCES

ABS	Aircraft Basic Science — Glencoe Division, Macmillan/McGraw-Hill Publication Company	CFR	Title 14 Code of Federal Regulations (Part or § (Section)) - GPO
AC	Advisory Circular	PSG	A&P Technician Powerplant Study Guide - Jeppesen Sanderson, Inc.
AEE	Aircraft Electricity and Electronics — Glencoe Division, Macmillan/McGraw-Hill Publication Company		
AMR	Aircraft Maintenance and Repair — Glencoe Division, Macmillan/McGraw-Hill Publication Company		
JSPT	A & P Technician Powerplant Textbook — Jeppesen Sanderson, Inc.	B01	Overhaul turbine engine
AP	Aircraft Powerplants — Glencoe Division, Macmillan/McGraw-Hill Publication Company	B02	Inspect, check, service, and repair turbine engines and turbine engine installations
		B03	Install, troubleshoot, and remove turbine engines



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INTRODUCTION

The *Aviation Mechanic Airframe Test Guide* is designed to help you prepare for the FAA Aviation Mechanic Airframe Knowledge computerized test. It covers FAA exam material that applies to general knowledge related to aircraft maintenance.

We recommend that you use this Test Guide in conjunction with the Jeppesen A&P Technician Airframe Textbook. The Test Guide is organized along the same lines as the Airframe Textbook, with 17 chapters and distinctive sections within most chapters. Questions are covered in the Test Guide in the same sequence as the material in the manual. References to applicable chapters and pages in the various manuals are included along with the answers.

Within the chapters, the FAA exam questions and answers appear consecutively in each column. The first line of the explanation for each question is in bold type and contains the correct answer, and the page reference if the question is covered in the *A&P Technician Airframe Textbook*. There is also a reference to an FAA or other authoritative source document, if appropriate.

Example: Answer B. JSAT 8-39 (AC65-15A)

Next is a brief explanation of the correct answer. An explanation of why the other answers are incorrect is sometimes included. In cases where no page reference or authoritative source is given, consider the explanation as a supplement to the textbook.

Abbreviations used in the Test Guide are as follows:

AC	—	Advisory Circular
AC 65-12A	—	FAA Powerplant AC
AC 65-15A	—	FAA Airframe AC
AC 65-9A	—	FAA General AC
FAR	—	Federal Aviation Regulation
JSAB	—	Jeppesen Aircraft Batteries
JSAD	—	The Aviation Dictionary
JSAT	—	Jeppesen Airframe Textbook
JSGT	—	Jeppesen General Textbook
JSHM	—	Helicopter Maintenance
JSHS	—	Aircraft Hydraulic Systems
JSPT	—	Jeppesen Powerplant Textbook
JSTS	—	Transport Category Aircraft Systems
JSTT	—	Aircraft Tires and Tubes
JSWB	—	Aircraft Weight and Balance
MMM	—	Manufacturer's Maintenance Manual
TSO	—	Technical Standard Order
ASTM	—	American Society for Testing and Materials
FA 150	—	Airborne Digital Logic Principles
WBH	—	FAA Aircraft Weight and Balance Handbook, FAA-H-8083-1

Since the FAA does not provide answers with their test questions, the answers in this Test Guide are based on official reference documents and, in our judgment, are the best choice of the available answers. Some questions which were valid when the FAA Computerized Test was originally released may no longer be appropriate due to changes in regulations or official operating procedures. However, with the computer test format, timely updating and validation of questions is anticipated. Therefore, when taking the FAA test, it is important to answer the questions according to the latest regulations or official operating procedures.

Appendix A includes Subject Matter Knowledge Codes and Areas from the FAA test materials. It also includes a useful cross-reference between Subject Matter Knowledge Codes and FAA Questions. Appendix B is a listing by chapter of sample questions and suggested answers that may be asked during the Oral and Practical Tests.

Figures in the Test Guide are the same as those used in the FAA Computerized Testing Supplement. These figures, which are referred to in many of the questions, are placed throughout the Test Guide as close as practical to the applicable questions. When a figure is not on the same page or facing page, a note will indicate the page number where you can find that figure.

While good study material is beneficial, it is important to realize that to become a safe, competent technician, you need more than just the academic knowledge required to pass a written test. A certified Airframe and Powerplant Mechanic's school will give you the practical shop skills that are indispensable to mechanics working in the field.

WHO CAN TAKE THE TEST

The Aviation Mechanic Airframe Exam is often taken in conjunction with the General or Powerplant exams. When you are ready to take these tests, you must present to the FAA, either a graduation certificate or certificate of completion from a certificated aviation maintenance technician school, or documentary evidence of practical work experience. For a single rating, you must show that you have at least 18 months of practical experience with the procedures, practices, and equipment generally used in constructing, maintaining, or altering airframes or powerplants. To test for both ratings, you must show at least 30 months of practical experience concurrently performing the duties appropriate to both the airframe and powerplant ratings. Documentary evidence of practical experience must be satisfactory to the administrator.

You must also provide evidence of a permanent mailing address, appropriate identification, and proof of your age. The identification must include a current photograph, your signature, and your residential address, if different from your mailing address. You may present this information in more than one form of identification, such as a driver's license, government identification card, passport, alien residency (green) card, or a military identification card.

Once the FAA is satisfied that you meet the eligibility requirements for an aircraft mechanic's certificate, you will be given two FAA Form 8610-2 forms to complete. Once filled out, an FAA inspector will review the forms for accuracy and completeness, and then sign them, authorizing you to take the required FAA tests. **DO NOT LOSE THESE FORMS.** You will be required to present them to FAA designated testing personnel to show evidence of eligibility to take the Airman Knowledge, Oral and Practical Exams.

HOW TO PREPARE FOR THE FAA TEST

It is important to realize that to become a safe, competent mechanic, you need more than just the academic knowledge required to pass a test. For a comprehensive training program, we recommend a structured maintenance school with qualified instructors. An organized course of instruction will help you complete the course in a timely manner, and you will be able to have your questions answered.

Regardless of whether or not you are in a structured ground training program, you will find that this Test Guide is an excellent training aid to help you prepare for the FAA tests. The guide contains all of the FAA questions as they are presented in the FAA computerized test format. By reviewing the questions and studying the Jeppesen Maintenance Training materials, you should be well equipped to take the test.

You will also benefit more from your study if you test yourself as you proceed through the Test Guide. Cover the answers as you read each question, and choose what you consider the best answer. You may want to mark the questions you miss for further study and review prior to taking the FAA exam.

The sooner you take the exam after you complete your study, the better. This way, the information will be fresh in your mind, and you will be more confident when you actually take the FAA test.

GENERAL INFORMATION—FAA COMPUTERIZED TEST

Detailed information on FAA computer testing is contained in FAA Order 8080.6, *Conduct of Airmen Knowledge Tests Via The Computer Medium*. This FAA order provides guidance for Flight District Standards Offices (FSDOs) and personnel associated with organizations that are participating in, or are seeking to participate in, the FAA Computer-Assisted Airmen Knowledge Testing Program. You may also refer to FAA Order 8300.1, *Airworthiness Inspector's Handbook*, for guidance on computer testing by FAR Part 147 maintenance training schools that hold examining authority.

As a test applicant, you don't need all of the details contained in FAA Orders, but you may be interested in some of the general information about computer testing facilities. A **Computer Testing Designee (CTD)** is an organization authorized by the FAA to administer FAA airmen knowledge tests via the computer medium. A **Computer Testing Manager (CTM)** is a person selected by the CTD to serve as manager of its national computer testing program. A **Testing Center Supervisor (TCS)** is a person selected by the CTM, with FAA approval, to administer FAA airmen knowledge tests at approved testing centers. The TCS is responsible for the operation of the testing center.

CTDs are selected by the FAA's Flight Standards Service. Those selected may include companies, schools, universities, or other organizations that meet specific requirements. For example, they must clearly demonstrate competence in computer technology, centralized database management, national communications network operation and maintenance, national facilities management, software maintenance and support, and technical training and customer support. They must provide computer-assisted testing, test administration, and data transfer service on a national scale. This means they must maintain a minimum of 20 operational testing centers geographically dispersed throughout the United States. In addition, CTD's must offer operational hours that are convenient to the public. An acceptable plan for test security is also required.

WHAT TO EXPECT ON THE COMPUTERIZED TEST

Computer testing centers are required to have an acceptable method for the "on-line" registration of test applicants during normal business hours. They must provide a dual method for answering questions, such as keyboard, touch screen, or mouse. Features that must be provided also include an introductory lesson to familiarize you with computer testing procedures, the ability to return to a test question previously answered (for the purpose of review or answer changes), and a suitable display of multiple-choice and other question types on the computer screen in one frame. Other required features include a display of the time remaining for the completion of the test, a "HELP" function which permits you to review test questions and optional responses, and provisions for your test score on an Airmen Computer Test Report.

On the computerized tests, the selection of questions is done for you, and you will answer the questions that appear on the screen. You will be given a specific amount of time to complete the test, which is based on past experience with others who have taken the exam. If you are prepared, you should have plenty of time to complete the test. After you begin the test, the screen will show you the time remaining for completion. When taking the test, keep the following points in mind:

1. Answer each question in accordance with the latest regulations and procedures. If the regulation or procedure has recently changed, and you answer according to the recent change, you will receive credit for the affected question. However, these questions will normally be deleted or updated on the FAA computerized tests.
2. Read each question carefully before looking at the possible answers. You should clearly understand the problem before attempting to solve it.

3. After formulating an answer, determine which of the alternatives most nearly corresponds with that answer. The answer chosen should completely resolve the problem.
4. From the answers given, it may appear that there is more than one possible answer; however, there is only one answer that is correct and complete. The other answers are either incomplete or are derived from popular misconceptions.
5. Make sure you select an answer for each question. Questions left unanswered will be counted as incorrect.
6. If a certain question is difficult for you, it is best to proceed to other questions. After you answer the less difficult questions, return to those which were unanswered. The computerized test format helps you identify unanswered questions, as well as those questions you wish to review.
7. When solving a calculator problem, select the answer nearest your solution. The problem has been checked with various types of calculators; therefore, if you have solved it correctly, your answer will be closer to the correct answer than the other choices.
8. Generally, the test results will be available almost immediately. Your score will be recorded on an Airmen Computer Test Report form, which includes subject matter knowledge codes for incorrect answers. To determine the knowledge area in which a particular question was incorrectly answered, compare the subject matter knowledge codes on this report to Appendix 1, Subject Matter Knowledge Codes in this book.

TEST MATERIALS, REFERENCE MATERIALS, AND AIDS

You are allowed to use an electronic calculator for this test. Simple programmable memories, which allow addition to, subtraction from, or retrieval of one number from the memory, are acceptable. Simple functions such as square root or percent keys are also acceptable.

In addition, you may use any reference materials provided with the test. You will find that these reference materials are the same as those in this book.

RETESTING

As stated in FAR section 65.19, an applicant who fails a test may not apply for retesting until 30 days after the date the test was failed. However, the applicant may apply for retesting before the 30 days have expired provided the applicant presents a signed statement from an airman holding the certificate and rating sought by the applicant. The statement must indicate that the airman has given the applicant additional instruction in each of the subjects failed and that the airman considers the applicant ready for retesting.

WHERE TO TAKE THE TEST

Testing is administered via computer at FAA-designated test centers. As indicated, these CTDs are located throughout the U.S. You can expect to pay a fee and the cost varies at different locations. The following are approved testing designees at the time of publication of this test guide. You may want to check with your local FSDO for changes.

Computer Assisted Testing Services (CATS)
1-800-947-4228
Outside U.S. (650) 259-8550

LaserGrade Computer Testing
1-800-211-2754
Outside U.S. (360) 896-9111

CHAPTER

1

AIRCRAFT STRUCTURAL ASSEMBLY AND RIGGING

SECTION A AIRCRAFT DESIGN AND CONSTRUCTION

Section A of Chapter 1 covers information related to aircraft designs, design and construction terminology, and basic aerodynamics.

1A-1 D05A

Longitudinal (fore and aft) structural members of a semi monocoque fuselage are called

- A — spars and ribs.
- B — longerons and stringers.
- C — spars and stringers.

Answer B. JSAT 1-4 (AC65-15A)
Primary bending loads in the semimonocoque fuselage are taken up by longitudinal members called longerons. These are supplemented by other longitudinal members called stringers.

1A-2 D05A

Which statement is true regarding a cantilever wing?

- A — No external bracing is needed.
- B — It requires only one lift strut on each side.
- C — It has nonadjustable lift struts.

Answer A. JSAT 1-9 (AC65-15A)
Wings of the cantilever design are built so that no external bracing is needed.

1A-3 D05A

The monocoque fuselage relies largely on the strength of

- A — bulkheads and longerons.
- B — longerons and formers.
- C — skin or covering.

Answer C. JSAT 1-3 (AC65-15A)
The monocoque fuselage relies largely on the strength of the skin or covering to carry the primary stresses.

1A-4 D05A

Which part(s) of a semi monocoque fuselage prevent(s) tension and compression from bending the fuselage?

- A — Bulkheads and skin.
- B — Longerons and stringers.
- C — The fuselage covering

Answer B. JSAT 1-15 (AC65-15A)
Stringers and longerons prevent tension and compression from bending the fuselage.

1A-5 F01A

The acute angle formed by the chord line of a wing and the relative wind is known as the

- A — angle of attack.
- B — angle of incidence.
- C — longitudinal dihedral angle.

Answer A. JSAT 1-5, JSGT 2-38 (AC65-15A)
Angle of attack is defined as the angle between the chord line of the wing and the direction of the relative wind.

1A-6 F02A

As the angle of attack of an airfoil increases, the center of pressure will

- A — move toward the leading edge.
- B — remain stationary because both lift and drag components increase proportionally to increased angle of attack.
- C — move toward the trailing edge.

Answer A. (AC65-15A)
On an asymmetrical airfoil, center of pressure moves forward as the angle of attack increases. On a symmetrical airfoil, center of pressure does not change with changes in angle of attack.

1A-7 F02A

The chord of a wing is measured from

- A — leading edge to trailing edge.
- B — wingtip to wingtip.
- C — wing root to the wingtip.

Answer A. JSAT 1-5 (AC65-15A)
The chord of an airfoil or wing section is an imaginary straight line which passes through the section from the leading edge to the trailing edge.

1A-8 F02A

When the lift of an airfoil increases, the drag will

- A — increase while the lift is changing but will return to its original value.
- B — also increase.
- C — decrease.

Answer B. JSGT 2-43 (AC65-15A)
The same factors that enter into the production of lift also produce drag. At low angles of attack, there is very little drag, but as the angle of attack increases, so does the drag.

1A-9 F02A

What physical factors are involved in the aspect ratio of airplane wings?

- A — Dihedral and angle of attack.
- B — Span and chord.
- C — Thickness and chord.

Answer B. JSGT 2-42 (AC65-15A)
The larger the wingspan is, as compared to the chord, the greater the lift obtained from the wing. This comparison of wingspan and chord is called the wing's aspect ratio.

1A-10 F03A

Where is the buttock line or butline of an aircraft?

- A — A height measurement left or right of, and perpendicular to, the horizontal centerline.
- B — A width measurement left of, and perpendicular to, the vertical centerline.
- C — A width measurement left or right of, and parallel to, the vertical centerline.

Answer C. JSGT 5-17 (AC65-15A)
The buttock line, or butt line, is a width measurement left or right of, and parallel to, the vertical center line.

1A-11 F03A

Where is fuselage station No. 137 located?

- A — Aft of the engine.
- B — 137 inches aft of the zero or fixed reference line.
- C — 137 centimeters aft of the nose or fixed reference line.

Answer B. JSGT 5-17 (AC65-15A)

Fuselage stations are numbered in inches from a reference, or zero point, known as the reference datum. The distance to a given point is measured in inches parallel to a center line, extending through the aircraft from the nose through the center of the tail cone.

SECTION B

AIRPLANE ASSEMBLY AND RIGGING

Section B of Chapter 1 covers information related to assembly and rigging terminology, assembly practices and techniques, and rigging flight control and fixed aerodynamic surfaces on airplanes.

1B-1 F02A

Wing dihedral, a rigging consideration on most airplanes of conventional design, contributes most to stability of the airplane about its

- A — longitudinal axis.
- B — lateral axis.
- C — vertical axis.

Answer A. JSAT 1-22 (AC65-15A)

Lateral stability (stability about the longitudinal axis), or roll stability, is provided primarily by dihedral in the wings. Dihedral is the positive acute angle between the wing and the lateral axis of the airplane.

1B-2 F02A

Other than the manufacturer maintenance manual what other document could be used to determine the primary flight control surface deflection for an imported aircraft that is reassembled after shipment?

- A — The certificate of airworthiness issued by the importing country.
- B — Import manual for the aircraft.
- C — Aircraft type certificate data sheet.

Answer C. JSAT 1-37 (AC65-15A)

The position of the wing attachment fuselage fittings will determine the angle of incidence for the wing. These fittings must be positioned exactly, according to specifications, or the aerodynamics of the aircraft will be altered.

1B-3 F02A

If a pilot reports that an airplane flies left wing heavy, this condition may be corrected by

- A — increasing the dihedral angle of the left wing, or decreasing the dihedral angle of the right wing, or both.
- B — increasing the angle of incidence of the left wing, or decreasing the angle of incidence of the right wing, or both.
- C — adjusting the dihedral angle of the left wing so that differential pressure between the upper and lower wing surfaces is increased.

Answer B. JSAT 1-39

Increasing the angle of incidence, that angle between the chord line of the wing and the longitudinal axis of the airplane, is called “washing the wing in”, and it increases the lift. If the left wing of an airplane is flying heavy, washing it in will increase its lift and probably correct the problem.

1B-4 F02A

If the vertical fin of a single engine, propeller driven airplane is rigged properly, it will generally be parallel to

- A — both the longitudinal and vertical axes.
- B — the vertical axis but not the longitudinal axis.
- C — the longitudinal axis but not the vertical axis.

Answer B. (AC65-15A)

On most single engine, propeller driven airplanes, the leading edge of the vertical fin is offset to the longitudinal center line to counteract spiraling slipstream.

1B-5 F02A

An airplane which has good longitudinal stability should have a minimum tendency to

- A — pitch.
- B — roll.
- C — yaw.

Answer A. JSAT 1-21 (AC65-15A)

When an aircraft has a tendency to keep a constant angle of attack with reference to the relative wind — that is, when it does not tend to put its nose down and dive, or lift its nose and stall — it is said to have longitudinal stability. Longitudinal stability refers to motion in pitch.

1B-6 F02A

The angle of incidence is that acute angle formed by

- A — a line parallel to the wing from root to tip and a line parallel to the lateral axis of the aircraft.
- B — a line parallel to the wing chord and a line parallel to the longitudinal axis of the aircraft.
- C — the angular difference between the setting of the main airfoil and the auxiliary airfoil (horizontal stabilizer) in reference to the longitudinal axis of the aircraft.

Answer B. JSAT 1-39 (AC65-15A)

The acute angle which the wing chord makes with the longitudinal axis of the aircraft is called the angle of incidence, or the angle of wing setting.

1B-7 F02A

An airplane's center of lift is usually located aft of its center of gravity

- A — to improve stability about the longitudinal axis.
- B — so that the airplane will have a tail heavy tendency.
- C — so that the airplane will have a nose heavy tendency.

Answer C. JSAT 1-22 (AC65-15A)

The longitudinal, or pitch, stability of an airplane determines its ability to be flown hands-off at any airspeed. The center of gravity is located ahead of the aerodynamic center of the wing, and in straight and level flight, the wing produces a nose-down moment.

1B-8 F02A

An airplane is controlled directionally about its vertical axis by the

- A — ailerons.
- B — elevator(s).
- C — rudder.

Answer C. JSAT 1-21 (AC65-15A)

Turning the nose of the aircraft causes the aircraft to rotate about its vertical axis. Rotation of the aircraft about the vertical axis is called yawing. This motion is controlled by using the rudder.

1B-9 F02A

The elevators of a conventional airplane are used to provide rotation about the

- A — vertical axis.
- B — longitudinal axis.
- C — lateral axis.

Answer C. JSAT 1-20 (AC65-15A)

When the nose of an aircraft is raised or lowered, it is rotated about its lateral axis. Elevators are the movable control surfaces that cause this rotation.

1B-10 F02A

Washing in the left wing of a monoplane, for purposes of rigging corrections after flight test, will have what effect on the lift and drag of that wing?

- A — Both drag and lift will decrease due to decreased angle of attack.
- B — Both drag and lift will increase due to increased angle of attack.
- C — The drag will decrease due to the effect of the lift increase.

Answer B. JSAT 1-39

Increasing the angle of incidence, that angle between the chord line of the wing and the longitudinal axis of the airplane, is called “washing the wing in” and it increases the lift. An increase in lift also means an increase in drag because of the increased angle of attack.

1B-11 F02A

What type of flap system increases the wing area and changes the wing camber?

- A — Fowler flaps.
- B — Slotted flaps.
- C — Split flaps.

Answer A. JSAT 1-31 (AC65-15A)

The use of Fowler flaps increases the camber of a wing and its surface area, and therefore the lift of the wing. A fowler flap not only increases camber of the wing, but it also moves rearward increasing the wing area.

1B-12 F02A

If the right wing of a monoplane is improperly rigged to a greater angle of incidence than designated in the manufacturer’s specifications, it will cause the

- A — airplane to be off balance both laterally and directionally.
- B — airplane to pitch and roll about the lateral axis.
- C — right wing to have both an increased lift and a decreased drag.

Answer A. JSAT 1-39 (AC65-15A)

When a wing is improperly rigged, so that it has a greater angle of incidence than the manufacturer calls for, the wing will produce more lift than it should. An aircraft in this condition will not be laterally, or directionally, stable.

1B-13 F02A

Improper rigging of the elevator trim tab system will affect the balance of the airplane about its

- A — vertical axis.
- B — lateral axis.
- C — longitudinal axis.

Answer B. JSAT 1-23 (AC65-15A)

By design, airplanes are nose heavy. The nose heavy tendency of airplanes is balanced out by a downward force on the horizontal stabilizer and elevator. If an elevator trim tab is improperly rigged, the pilot will need to hold pressure on the control column to keep the airplane flying straight and level.

1B-14 F02A

An airplane that has a tendency to gradually increase a pitching moment that has been set into motion has

- A — poor lateral stability.
- B — poor longitudinal stability.
- C — good lateral stability.

Answer B. JSAT 1-22 (AC65-15A)

When an aircraft has a tendency to keep a constant angle of attack with reference to the relative wind—that is, when it does not tend to put its nose down and dive, or lift its nose and stall—it is said to have longitudinal stability. When an aircraft has a tendency to increase its pitching movement once it has been set in motion, it has very poor longitudinal stability.

1B-15 F02A

The purpose of wing slats is to

- A — reduce stalling speed.
- B — decrease drag.
- C — increase speed on takeoff.

Answer A. JSAT 1-32 (AC65-15A)

Many high performance airplanes have a portion of the wing leading edge mounted on tracks so it can extend outward and create a duct to direct high energy air down over the surface and delay separation to a very high angle of attack. These devices are known as slats, and they serve to reduce the stall speed of the airplane.

1B-16 F02A

The angle of incidence of an airplane at rest

- A — does not change when in flight.
- B — affects the dihedral of the wings in flight.
- C — is the same as the angle between the relative wind and the chord of the wing.

Answer A. JSAT 1-39 (AC65-15A)

The angle of incidence for an airplane's wing is the angle between the wing chord and the longitudinal axis of the airplane. Setting up this angle is part of rigging the wing, and once it is set it does not change (for most wings).

1B-17 F02A

Buffeting is the intermittent application of forces to a part of an airplane. It is caused by

- A — incorrect rigging of flaps.
- B — an unsteady flow from turbulence.
- C — incorrect rigging of ailerons.

Answer B. JSAD (AC65-15A)

Turbulence, or erratic movement of air currents, can cause buffeting in an aircraft. If the aircraft has proper stability, as turbulence ceases, the aircraft will return to its original flight condition.

1B-18 F02A

Movement of an airplane along its lateral axis (roll) is also movement

- A — around or about the longitudinal axis controlled by the elevator.
- B — around or about the lateral axis controlled by the ailerons.
- C — around or about the longitudinal axis controlled by the ailerons.

Answer C. JSAT 1-20 (AC65-15A)

When an aircraft is moving along its lateral axis, it means that it is moving in a rolling direction (one wing dropping and the other one rising). Movement along the lateral axis is also movement about the longitudinal axis, or the nose to tail axis, and this is controlled by the ailerons.

1B-19 F02A

The primary purpose of stall strips is to

- A — provide added lift at high angles of attack.
- B — stall the inboard portion of the wings first.
- C — provide added lift at slow speeds.

Answer B. JSAT 1-32

Stall strips provide a progressive stall and help maintain control during a stall. Should they be removed for maintenance, stall strips must be re-installed in the correct location.

1B-20 F02A

Rigging and alignment checks should not be undertaken in the open; however, if this cannot be avoided, the aircraft should be positioned

- A — facing any direction since it makes no difference if the wind is steady (not gusting).
- B — with the nose into the wind.
- C — obliquely into the wind.

Answer B. JSAT 1-39 (AC65-15A)

Normally, rigging and alignment checks should not be done in the open. If this cannot be avoided, the aircraft should be positioned with the nose into the wind. All measurements should be taken in a condition closest to that of normal flight. Follow aircraft manufacturer's instructions for rigging conditions.

1B-21 F03A

The correct dihedral angle can be determined by

- A — measuring the angular setting of each wing at the rear spar with a bubble protractor.
- B — placing a straightedge and bubble protractor across the spars while the airplane is in flying position.
- C — using a dihedral board and bubble level along the front spar of each wing.

Answer C. JSAT 1-39 (AC65-15A)

After installing a wing, the wing is adjusted to get the proper dihedral. This is determined by using a dihedral board that has a specific taper. It is held against the main spar on the bottom of the wing, at the location specified by the manufacturer. It is essential that the airplane be level, both longitudinally and laterally, when this check is made. A bubble level is used to check this.

1B-22 F03A

The dihedral angle of a wing may be measured by placing a straightedge and level protractor on the

- A — wing chord.
- B — front spar.
- C — wing root.

Answer B. JSAT 1-39

After installing a wing, the wing is adjusted to get the proper dihedral. This is determined by using a dihedral board that has a specific taper. It is held against the main spar on the bottom of the wing, at the location specified by the manufacturer. It is essential that the airplane be level, both longitudinally and laterally, when this check is made. A bubble level is used to check this.

1B-23 F03A

Where would you find precise information to perform a symmetry alignment check for a particular aircraft?

- A — Aircraft Specification or Type Certificate Data Sheet.
- B — Manufacturer's service bulletins.
- C — Aircraft service or maintenance manual.

Answer C. JSAT 1-38 (AC65-15A)

The precise figures, tolerances and checkpoints for a particular aircraft's symmetry check will be found in the applicable service or maintenance manual.

1B-24 F03A

Proper wing twist in a sheet metal constructed wing can usually be checked by utilizing a

- A — plum bob, string, and straightedge.
- B — straightedge, tape measure, and carpenter's square.
- C — bubble level and special fixtures described by the manufacturer.

Answer C. JSAT 1-39 (AC65-15A)

Incidence is usually checked on the surface of the wing at two specific locations to ensure that the wing is free from twist. A variety of incidence boards are used, along with a bubble level, to check for the proper angle of incidence.

1B-25 F04A

The vast majority of aircraft control cables are terminated with swaged terminals, that must be

- A — corrosion treated to show compliance with the manufacturers requirements after the swaging operation.
- B — pull tested to show compliance with the manufacturers requirements after the swaging operation.
- C — checked with a go-no-go gauge before and after, to show compliance with the manufacturers requirements after the swaging operation.

Answer C. JSAT 1-43, JSGT 8-36
(AC43.13-1B)

After a control cable has been swaged, the junction of the swaged fitting and the cable is painted with red paint. At all subsequent service inspections of the swaged fittings, the painted section is checked for any cable slippage.

1B-26 F04A

What nondestructive checking method is normally used to ensure that the correct amount of swaging has taken place when installing swaged-type terminals on aircraft control cable?

- A — Check the surface of the swaged portion of the terminal for small cracks which indicate incomplete swaging.
- B — Measure the finished length of the terminal barrel and compare with the beginning length.
- C — Use a terminal gauge to check the diameter of the swaged portion of the terminal.

Answer C. JSAT 1-43 (AC43.13-1B)
After the compression of the fitting is completed, it should be checked with a special gage. If the compressions have been properly made, the fitting will exactly fit the gage.

1B-27 F04A

When inspecting a control cable turnbuckle for proper installation, determine that

- A — the terminal end threads are visible through the safety hole in the barrel.
- B — the safety wire ends are wrapped a minimum of four turns around the terminal end shanks.
- C — no more than four threads are exposed on either side of the turnbuckle barrel.

Answer B. JSAT 1-47 (AC43.13-1B)
In the single and double wrap methods of safetying turnbuckles, there is an option of straight or spiral wiring. In either method, the wiring must be terminated with at least four wraps around the shank of the turnbuckle.

1B-28 F04A

If all instructions issued by the swaging tool manufacturer are followed when swaging a cable terminal, the resultant swaged terminal strength should be

- A — the full rated strength of the cable.
- B — 70 percent of the full rated strength of the cable.
- C — 80 percent of the full rated strength of the cable.

Answer A. JSGT 8-36 (AC43.13-1B)
When swaging tools are used, it is important that all the manufacturer's instructions, including "go and no go" dimensions, be followed in detail to avoid defective and inferior swaging. Observance of all instructions should result in a terminal developing the full rated strength of the cable.

1B-29 F04A

Which is an acceptable safety device for a castle nut when installed on secondary structures?

- A — Star washer.
- B — Cotter pin.
- C — Lockwasher.

Answer B. JSGT 8-29 (AC43.13-1B)
In normal practice, a cotter pin is the only safety device used on a castle nut and is the correct choice. In some special installations safety wire will be used.

1B-30 F04A

When used in close proximity to magnetic compasses, cotter pins are made of what material?

- A — Anodized aluminum alloy.
- B — Corrosion resisting steel.
- C — Cadmium plated low carbon steel.

Answer B. (AC65-9A)

The AN381 corrosion-resistant steel cotter pin is used in locations where nonmagnetic material is required, or in locations where resistance to corrosion is desired.

1B-31 F04A

When a fiber or nylon insert-type, self-locking nut can be threaded on a bolt or stud through the insert with only the fingers, it should be

- A — reused only in a different location.
- B — rejected.
- C — re-torqued frequently.

Answer B. (AC43.13-1B)

When fiber-type self-locking nuts are reused, check the fiber carefully to make sure it has not lost its locking friction, or become brittle. Do not reuse lock-nuts if they can be run up finger tight.

1B-32 F04A

The purpose of the vertical fin is to provide

- A — lateral stability.
- B — directional stability.
- C — longitudinal stability.

Answer B. JSAT 1-22 (AC65-15A)

Stability about the vertical axis is referred to as directional stability. The vertical stabilizer is the primary surface which controls directional stability.

1B-33 F05A

How are changes in direction of a control cable accomplished?

- A — Pulleys.
- B — Fairleads.
- C — Bell cranks.

Answer A. JSAT 1-44

Aircraft manufacturers generally route the control cables in the most direct manner possible. At points where a change in direction is needed, a pulley is used. These pulleys must be carefully aligned so the cable rides squarely in the center of the pulley's groove.

1B-34 F05A

What is the smallest size cable that may be used in aircraft primary control systems?

- A — 1/8 inch
- B — 1/4 inch
- C — 5/16 inch

Answer A. JSAT 1-47

Each cable, cable fitting, turnbuckle, splice, and pulley used in a small airplane must meet approved specifications. In addition, no cable smaller than 1/8" diameter may be used in primary control systems.

1B-35 F05A

After repairing or recovering a rudder, the surface should be rebalanced

- A — in its normal flight position.
- B — to its spanwise axis.
- C — to manufacturer's specifications.

Answer C. JSAT 1-49 (AC65-15A)

Any time repairs on a control surface add weight fore or aft of the hinge center line, the control surface must be re-balanced. Any control surface that is out of balance will be unstable and will not remain in a streamlined position during normal flight.

1B-36 F05A

Placing a piece of cloth around a stainless steel control cable and running it back and forth over the length of the cable is generally a satisfactory method of

- A — applying par-al-ketone.
- B — inspecting for wear or corrosion.
- C — inspecting for broken wires.

Answer C. JSAT 1-43

Using a piece of cloth to check cables for broken strands protects your hands from injury.

1B-37 F05A

The cable operated control system of an all metal aircraft, not incorporating a temperature compensating device, has been rigged to the correct tension in a heated hangar. If the aircraft is operated in very cold weather, the cable tension will

- A — decrease when the aircraft structure and cables become cold.
- B — increase when the aircraft structure and cables become cold.
- C — be unaffected if stainless steel cable is installed.

Answer A. JSAT 1-46, JSAT 8-35 (AC65-15A)

The answer requires some simple logic. Aluminum expands greater than steel, therefore a hot airplane is longer. The cables expand also, but not to the same extent. Cable tension is a specified average. When hot they are too tight; cold, too loose.

1B-38 F05A

Very often, repairs to a control surface require static rebalancing of the control surface. Generally, flight control balance condition may be determined by

- A — suspending the control surface from its leading edge in the streamline position and checking weight distribution.
- B — the behavior of the trailing edge when the surface is suspended from its hinge points.
- C — checking for equal distribution of weight throughout the control surface.

Answer B. JSAT 1-49, JSAT 2-94

To eliminate flutter it is extremely important that control surfaces be balanced so that their center of gravity does not fall behind their hinge line.

1B-39 F05A

Excessive wear on both of the sides of a control cable pulley groove is evidence of

- A — excessive cable tension.
- B — pulley misalignment.
- C — cable misalignment.

Answer B. JSAT 1-45 (AC43.13-1B)

The wear patterns in control cable pulley grooves can tell a great deal about the cable and pulley installation. Pulley misalignment will cause excessive wear to both sides of the pulley groove. Excess tension will wear evenly, but excessively deep on entire pulley groove.

1B-40 F05A

Fairleads should never deflect the alignment of a cable more than

- A — 12°.
- B — 3°.
- C — 8°.

Answer B. (AC43.13-1B)

When inspecting fairleads for wear and alignment, the technician must ensure that the cable deflection is no greater than 3°.

1B-41 F05A

Where does the breakage of control cable wires occur most frequently?

- A — Breakage usually occurs where cables are swaged to turnbuckle and ball terminals.
- B — Breakage sites are unpredictable and usually occur randomly anywhere along the length of a cable.
- C — Breakage usually occurs where cables pass over pulleys and through fairleads.

Answer C. JSAT 1-43 (AC43.13-1B)
Control cable wires are worn by mostly by friction when they come into contact with pulleys and fairleads. These areas experience the most frequent breakage of Control cable wires.

1B-42 F05A

With which system is differential control associated?

- A — Aileron.
- B — Trim.
- C — Elevator.

Answer A. JSAT 1-26 (AC65-15A)
Differential aileron travel provides more aileron up travel than down travel for a given movement of the control stick or wheel in the cockpit.

1B-43 F05A

Which statement concerning the 100-hour inspection of an airplane equipped with a push pull tube type control system is true?

- A — The terminal end threads of the turnbuckles should be visible through the safety hole in the barrel.
- B — The threaded rod ends should not be adjusted in length for rigging purposes because the rod ends have been properly positioned and staked during manufacture.
- C — The threaded rod ends should be checked for the amount of thread engagement by means of the inspection hole provided.

Answer C. JSAT 1-47
When inspecting a push/pull tube-type control system, the technician should check to be sure that the rod ends are screwed far enough into the fitting. This is accomplished by checking the small hole drilled into the fitting. If a piece of safety wire can pass through the hole, the rod end is not screwed in far enough.

1B-44 F05A

If control cables are adjusted properly and the control surfaces tend to vibrate, the probable cause is

- A — oil can effects on the control surfaces.
- B — excessive cable tension.
- C — worn attachment fittings.

Answer C. (AC43.13-1B)
If a control surface is properly balanced, rigged, and adjusted, the most likely cause of vibration is too much play in the attachment fittings due to wear. To correct this, the fittings would need to be replaced.

1B-45 F05A

Aircraft flight control trim systems must be designed and installed so that the

- A — pilot can determine the relative position of the trim tab from the cockpit.
- B — operating control and the trim tab will always move in the same direction.
- C — trim system will disengage or become inoperative if the primary flight control system fails.

Answer A. JSAT 1-29 (FAR 23.677)
FAR 23.677 states that a pilot must be able to determine the current position of the trim tabs as well as the neutral position of trim controls for lateral and directional trim.

1B-46 F05A

Stability about the axis which runs parallel to the line of flight is referred to as

- A — longitudinal stability.
- B — lateral stability.
- C — directional stability.

Answer B. JSAT 1-24 (AC65-15A)
Movement of an aircraft about its longitudinal (fore and aft) axis is a lateral, or rolling, motion. The tendency to return to the original attitude from such motion is called lateral stability.

1B-47 F05A

The purpose of spring tabs or servo tabs is to

- A — contribute to the static balance of the control surface.
- B — make in flight trim adjustments possible.
- C — assist the pilot in moving the control surfaces.

Answer C. JSAT 1-29 (AC65-15A)
Servo tabs aid in moving the control surface and holding it in position. Spring tabs are used to aid in moving a primary control surface.

1B-48 F05A

If the control stick of an aircraft with properly rigged flight controls is moved rearward and to the left, the right aileron will move

- A — up and the elevator will move down.
- B — down and the elevator will move down.
- C — down and the elevator will move up.

Answer C. JSAT 1-24 — 1-26 (AC65-15A)
Moving the control stick back and to the left is telling the airplane to climb and bank to the left. Climbing is accomplished by moving the elevator up, creating a downward force on the tail to raise the nose. Banking to the left is accomplished by moving the right wing aileron down to increase the lift on the right wing, and moving the left wing aileron up, to decrease the lift on the left wing.

1B-49 F05A

Movement of the cockpit control toward the nose down position during a ground operational check of the elevator trim tab system will cause the trailing edge of the trim tab to move in which direction?

- A — Downward regardless of elevator position.
- B — Upward regardless of elevator position.
- C — Downward if the elevator is in the UP position and upward if the elevator is in the DOWN position.

Answer B. JSAT 1-28 (AC65-15A)
Moving the cockpit control for the elevator trim tabs toward the nose down position is telling the airplane that you want the elevator to move down, because this will cause the nose of the airplane to come down. For a trim tab to work, it needs to move in the opposite direction of the way you want the flight control to move.

1B-50 F05A

If the control stick of an aircraft with properly rigged flight controls is moved forward and to the right, the left aileron will move

- A — down and the elevator will move up.
- B — up and the elevator will move down.
- C — down and the elevator will move down.

Answer C. JSAT 1-24 — 1-26 (AC65-15A)
Moving the control stick forward and to the right is telling the airplane to descend and to bank to the right. To drop the nose of the airplane the elevator needs to move down to put an upward force on the tail. To bank the airplane to the right, the aileron on the right wing needs to come up to decrease the lift on that wing, and the aileron on the left wing needs to move down to increase the lift on that wing.

1B-51 F05A

If the travel of an airplane's controls is correct but the cables are rigged exceptionally tight, what probable effect will this have when flying the airplane?

- A — The pilot will be unable to fly the airplane hands off.
- B — The airplane will be heavy on the controls.
- C — The airplane will tend to fall off on one wing.

Answer B. JSAT 1-45 (AC65-15A)
When cables are rigged excessively tight, it creates a great deal of strain on the system. Not only does premature wearing of the pulleys take place, but the flight controls will also feel very heavy and difficult to move because of the strain. The manufacturer sets procedures for achieving the best balance between control response and control looseness.

1B-52 F05A

During inspection of the flight control system of an airplane equipped with differential-type aileron control, side to side movement of the control stick will cause

- A — each aileron to have greater down travel (from the streamlined position) than up travel.
- B — the left aileron to move through a greater number of degrees (from full up to full down) than the right aileron.
- C — each aileron to have a greater up travel (from the streamlined position) than down travel.

Answer C. JSAT 1-26 (AC65-15A)
Differential aileron control on an airplane provides more aileron up travel than down travel for a given movement of the control column.

1B-53 F05A

A universal propeller protractor used to measure the degrees of aileron travel should be zeroed

- A — with the aileron in the DOWN position.
- B — with the aileron in the NEUTRAL position.
- C — when the aircraft is in a level flight attitude.

Answer B. JSAT 1-40 (AC65-15A)
When using the universal propeller protractor to measure control surface travel, the control surface must be moved to neutral before the protractor is placed on the surface, and the ring adjuster turned to center the bubble in the spirit level.

1B-54 F05A

The universal propeller protractor can be used to measure

- A — propeller track.
- B — aspect ratio of a wing.
- C — degrees of flap travel.

Answer C. JSAT 1-40 (AC65-15A)
The universal propeller protractor can be used to measure the travel of a control surface that has up and down movement. The flaps have such a movement.

1B-55 F05A

A tension regulator in the flight control cable system of a large all metal aircraft is used primarily to

- A — provide a means of changing cable tension in flight.
- B — retain a set tension.
- C — increase the cable tension in cold weather.

Answer B. JSAT 1-46 (AC65-15A)
Cable tension regulators are used in some flight control systems because there is considerable difference in temperature expansion of the aluminum aircraft structure and the steel control cables. Some large aircraft incorporate tension regulators in the control cable systems to automatically maintain a given cable tension.

1B-56 F05A

Differential control on an aileron system means that

- A — one aileron on one wing travels further up than the aileron on the opposite wing to adjust for wash in and wash out.
- B — the up travel is more than the down travel.
- C — the down travel is more than the up travel.

Answer B. JSAT 1-26 (AC65-15A)
Differential aileron travel provides more aileron up travel than down travel.

1B-57 F05A

(Refer to Airframe figure 8) Identify the cable that is used in primary control systems and in other places where operation over pulleys is frequent.

- A — 2.
- B — 1.
- C — 3.

Answer C. JSAT 1-41 (AC65-9A)
The 7 x 19 cable is made up of seven strands of 19 wires each. It is extra flexible, and is used in primary control systems.

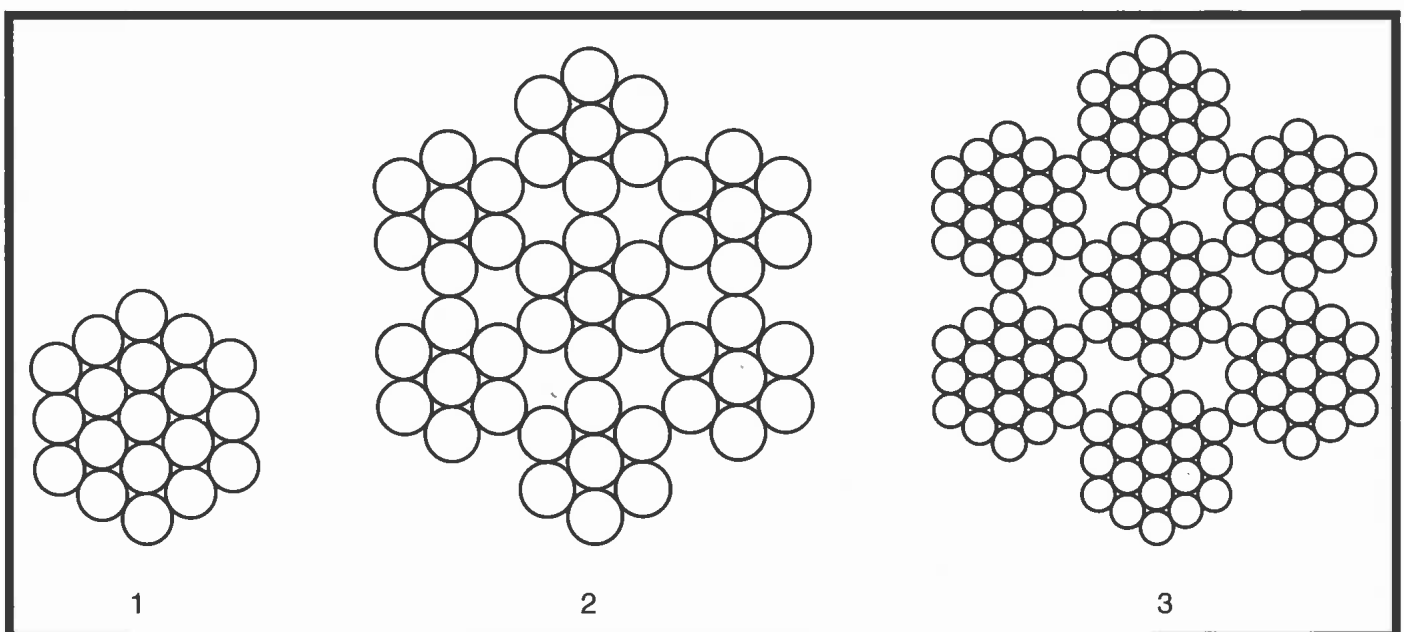


Figure 8. — Control Cable

1B-58 F05A

(Refer to Airframe figure 9) When the outside air temperature is 80°F, select the acceptable 3/16 cable tension range.

- A — 130 pounds minimum, 140 pounds maximum.
- B — 120 pounds minimum, 140 pounds maximum.
- C — 117 pounds minimum, 143 pounds maximum.

Answer C. JSAT 1-46 (AC65-15A)
Determine the size of the cable to be adjusted and the outside air temperature (OAT). In this case, use the 3/16 rigging load curve and 80°F. Follow the 80°F line upward until it intersects the 3/16 curve. Extend a horizontal line from the point of intersection to the left edge of the chart. The value at this point indicates the correct cable tension. Remember to compensate for the 10% tolerance by adding and subtracting 13 lbs. from the result. (130 lbs. +/- 13 lbs. = 117 lbs. to 143 lbs.)

1B-59 F06A

Why is it generally necessary to jack an aircraft indoors for weighing?

- A — So that air currents do not destabilize the scales.
- B — So weighing scales may be calibrated to 0 pounds.
- C — So aircraft may be placed in a level position.

Answer A. JSWB 26 (AC65-9A)
If possible, aircraft should be weighed in a closed building where there are no air currents to cause incorrect scale readings.

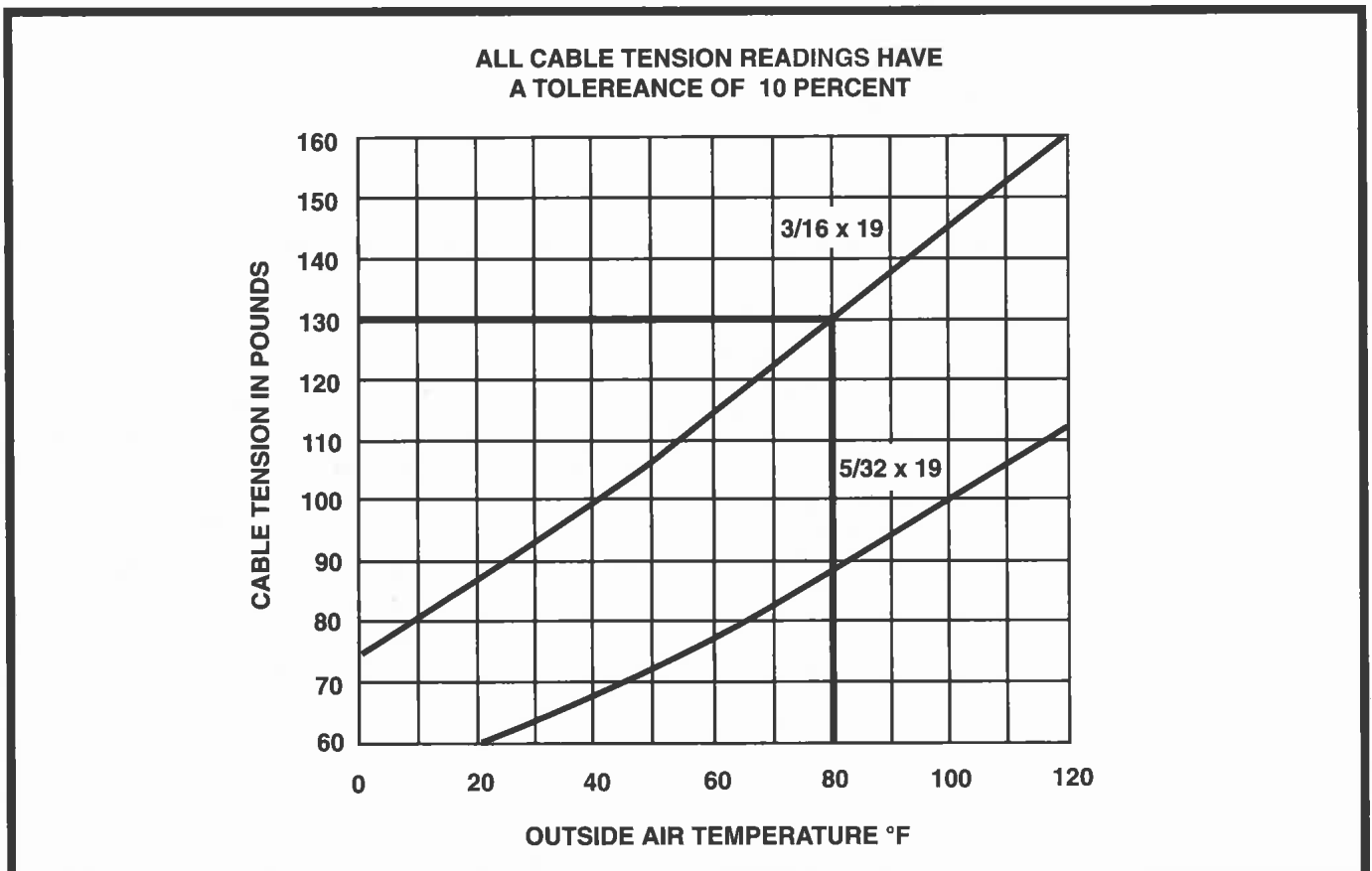


Figure 9. — Cable Tension Chart

1B-60 F06A

Which should be accomplished before jacking an aircraft?

- A — Install critical stress panels or plates.
- B — Determine that the fuel tanks are empty.
- C — Make sure the aircraft is leveled laterally.

Answer A. JSGT 13-10 (AC65-9A)

Prior to jacking an aircraft, it should be determined if the aircraft configuration will permit it. On some aircraft, the stress panels or plates must be in place when the aircraft is jacked to avoid structural damage. Always consult manufacturer's data to determine if stress panels are required to be in place for jacking.

SECTION C

FUNDAMENTALS OF ROTARY-WING AIRCRAFT

Section C of Chapter 1 covers helicopter, or rotary-wing, aircraft including helicopter aerodynamics, assembly and rigging nomenclature and procedures, and rotor blade balancing and tracking nomenclature.

1C-1 F01A

The auxiliary (tail) rotor of a helicopter permits the pilot to compensate for and/or accomplish which of the following?

- A — Attitude and airspeed.
- B — Lateral and yaw position.
- C — Torque and directional control.

Answer C. JSAT 1-65

The tail rotor, controlled by pedals operated by the pilot, compensates for the torque of the main rotor and provides directional control.

1C-2 F01A

The vertical flight of a helicopter is controlled by

- A — collective pitch changes.
- B — cyclic pitch changes.
- C — increasing or decreasing the RPM of the main rotor.

Answer A. JSAT 1-58 (AC65-15A)

The collective pitch control varies the lift of the main rotor by increasing or decreasing the pitch of all blades at the same time. This changing of lift on the blades controls the vertical flight of the helicopter.

1C-3 F01A

A decrease in pitch angle of the tail rotor blades on a helicopter

- A — causes the tail to pivot in the opposite direction of torque rotation around the main rotor axis.
- B — causes the tail to pivot in the direction of torque rotation around the main rotor axis.
- C — is required to counteract main rotor torque produced by takeoff RPM.

Answer B. JSAT 1-57 (AC65-15A)

The tail rotor blades on a helicopter counteract the effect of the torque produced when the engine drives the main rotor blades. If the pitch angle on the tail rotor blades is decreased, the rotor will produce less thrust and the helicopter's tail will rotate in the direction of torque.

1C-4 F01A

In rotorcraft external-loading, the ideal location of the cargo release is where the line of action passes

- A — aft of the center of gravity at all times.
- B — forward of the center of gravity at all times.
- C — through the center of gravity at all times.

Answer C. JSHM 323 (AC43.13-1B)

The FAR's specify the requirements for quick-release devices used in conjunction with helicopter external load operations. The ideal location of the cargo release would allow the line of action to always pass through the helicopter's center-of-gravity.

1C-5 F01A

A helicopter in forward flight, cruise configuration, changes direction by

- A — varying the pitch of the main rotor blades.
- B — changing rotor RPM.
- C — tilting the main rotor disk in the desired direction.

Answer C. JSAT 1-62 (AC65-15A)

The rapidly rotating rotor blades create a disk area that can be tilted in any direction with respect to the supporting rotor mast. Horizontal movement is controlled by changing the direction of tilt of the main rotor to produce a force in the desired direction.

1C-6 F01A

The purpose in checking main rotor blade tracking is to determine the

- A — extent of an out of balance condition during rotation.
- B — flight path of the blades during rotation.
- C — relative position of the blades during rotation.

Answer B. JSAT 1-69

Rotor blade tracking determines that each blade follows directly in the path of the blade in front of it.

1C-7 F01A

In a hovering helicopter equipped with a tail rotor, directional control is maintained by

- A — tilting the main rotor disk in the desired direction.
- B — changing the tail rotor RPM.
- C — varying the pitch of the tail rotor blades.

Answer C. JSAT 1-66 (AC65-15A)

In addition to being used to counteract the torque of the main rotor, the tail rotor also provides directional control when the helicopter is in a hover.

1C-8 F01A

If a single rotor helicopter is in forward horizontal flight, the angle of attack of the advancing blade is

- A — equal to the retreating blade.
- B — more than the retreating blade.
- C — less than the retreating blade.

Answer C. JSAT 1-59 (AC65-15A)

When a helicopter is moving forward, the blade on the right side of the helicopter is moving forward, against airflow, and the blade on the left side is moving aft, with the airflow. This causes the advancing blade to produce more lift, and therefore rise. The retreating blade produces less lift and will drop. The dropping of the retreating blade increases its angle of attack and helps solve the potential problem of dissymmetry of lift.

1C-9 F01A

Main rotor blades that do not cone by the same amount during rotation are said to be out of

- A — balance.
- B — collective pitch.
- C — track.

Answer C. JSAT 1-69, JSAT 2-62 (AC65-15A)
When the main rotor blades do not “cone” by the same amount during rotation, it is referred to as “out of track”.

1C-10 F01A

One purpose of the freewheeling unit required between the engine and the helicopter transmission is to

- A — disconnect the rotor from the engine to relieve the starter load.
- B — automatically disengage the rotor from the engine in case of an engine failure.
- C — permit practice of autorotation landings.

Answer B. JSAT 1-72

The freewheeling unit allows the engine to drive the rotor, but if engine speed is slower than rotor speed, the freewheeling unit automatically disengages. This prevents the rotor from attempting to drive the engine in the event of an engine failure.

1C-11 F01A

Which statement is correct concerning torque effect on helicopters?

- A — As horsepower decreases, torque increases.
- B — Torque direction is the opposite of rotor blade rotation.
- C — Torque direction is the same as rotor blade rotation.

Answer B. JSAT 1-57 (AC65-15A)
Newton's Third Law of Motion states, "For every action there is an equal and opposite reaction." As the main rotor of a helicopter turns in one direction, the fuselage tends to rotate in the opposite direction. This tendency for the fuselage to rotate is called torque.

1C-12 F01A

What is the purpose of the free wheeling unit in a helicopter drive system?

- A — It releases the rotor brake for starting.
- B — It relieves bending stress on the rotor blades during starting.
- C — It disconnects the rotor whenever the engine stops or slows below the equivalent of rotor RPM.

Answer C. JSAT 1-72
The freewheeling device in a helicopter disconnects the engine from the rotor any time the speed of the engine drops below equivalent of rotor RPM. In the case of an engine failure, it is essential that the engine be disconnected immediately to prevent the engine from slowing the rotor and preventing autorotation.

1C-13 F01A

Movement about the longitudinal axis (roll) in a helicopter is effected by movement of the

- A — cyclic pitch control.
- B — collective pitch control.
- C — tail rotor pitch control.

Answer A. JSAT 1-64 (AC65-15A)
Movement about the longitudinal axis is called roll. This is effected by moving the cyclic pitch control to the right or left.

1C-14 F01A

Movement about the lateral axis (pitch) in a helicopter is effected by movement of the

- A — collective pitch control.
- B — cyclic pitch control.
- C — tail rotor pitch control.

Answer B. JSAT 1-64 (AC65-15A)
Movement about the lateral axis produces a nose up or nose down attitude. This is effected by moving the cyclic pitch control fore and aft.

SHEET METAL STRUCTURES

SECTION A METALLIC AIRCRAFT CONSTRUCTION

The first section of Chapter 2 covers aircraft sheet metal nomenclature, including physical characteristics and identification of sheet metal. Typical load failure terminology associated with sheet metal structures and rivets is also included in this section.

2A-1 D07A

The aluminum alloys used in aircraft construction are usually hardened by which method?

- A — Heat treatment.
- B — Aging.
- C — Cold working.

Answer A. JSAT 2-8 (AC65-9A)

Heat treatment is a series of operations involving the heating and cooling of metals in the solid state. Its purpose is to change a mechanical property or combination of mechanical properties so that the metal will be more useful, serviceable, and safe for a definite purpose. By heat treating, a metal can be made harder, stronger, and more resistant to impact.

2A-2 D05A

When repairing a small hole on a metal stressed skin, the major consideration in the design of the patch should be

- A — that the bond between the patch and the skin is sufficient to prevent dissimilar metal corrosion.
- B — the shear strength of the riveted joint.
- C — to use rivet spacing similar to a seam in the skin.

Answer B. JSAT 2-5, JSAT 2-50

When repairing a small hole on a metal stressed skin, the riveted joint needs to be designed so that the rivets take the stress, and not the skin, so if there is a failure, it will be the rivets that shear and not the skin that tears.

2A-3 D05A

Clad aluminum alloys are used in aircraft because they

- A — are stronger than unclad aluminum alloys.
- B — are less subject to corrosion than uncoated aluminum alloys.
- C — can be heat treated much easier than the other forms of aluminum.

Answer B. JSAT 2-8 (AC65-9A)

Clad aluminum alloys consist of an aluminum alloy core coated with a layer of pure aluminum, to a depth of approximately 5-1/2% on each side. The pure aluminum coating affords a dual protection for the core, preventing contact with any corrosive agents, and protecting the core electrolytically by preventing any attack caused by scratching, or from other abrasions.

2A-4 D05A

When fabricating parts from Alclad 2024-T3 aluminum sheet stock,

- A — bends should be made with a small radius to develop maximum strength.
- B — all bends must be 90° to the grain.
- C — all scratches, kinks, tool marks, nicks, etc., must be held to a minimum.

Answer C. JSAT 2-8 (AC65-9A)

Alclad 2024-T3 aluminum has a pure aluminum coating over the aluminum alloy core. If the coating is damaged, the aluminum alloy will be subject to outside corrosive elements.

2A-5 D06A

The primary alloying agent of 2024-T36 is indicated by the number

- A — 20.
- B — 24.
- C — 2.

Answer C. JSAT 2-7 (AC65-9A)

The first digit in this aluminum alloy 2024 number indicates what the primary alloying agent is. 1000 series would indicate almost pure aluminum. 2000 series would indicate copper as the primary alloying agent. 3000 series would indicate manganese as the primary alloying agent, and so on.

2A-6 D06A

Which part of the 2017-T36 aluminum alloy designation indicates the primary alloying agent used in its manufacture?

- A — 20.
- B — 17.
- C — 2.

Answer C. JSAT 2-7 (AC65-9A)

In the 2xxx through 8xxx groups, the first digit indicates the major alloying agent used in the formation of the alloy. A head is the only way to tell what alloy the rivet is actually made of.

2A-7 D06A

Mild steel rivets are used for riveting

- A — nickel steel parts.
- B — magnesium parts.
- C — steel parts.

Answer C. JSAT 12-9 (AC65-9A)

Mild steel rivets are used for riveting steel parts. Metals of the same galvanic grouping show little tendency to corrode.

2A-8 D06A

When riveting dissimilar metals together, what precautions must be taken to prevent an electrolytic action?

- A — Avoid the use of dissimilar metals by redesigning the unit according to the recommendations outlined in AC 43.13-1A.
- B — Treat the surfaces to be riveted together with a process called anodic treatment.
- C — Place a protective separator between areas of potential electrical difference.

Answer C. JSAT 2-13, JSAT 12-30 (AC65-9A)

To prevent corrosion between dissimilar metal joints in which magnesium alloy is involved, two coats of zinc chromate are applied to each surface. Then a layer of pressure-sensitive vinyl tape is applied smoothly and firmly enough to prevent air bubbles and wrinkles. The separating material may be metal primer, aluminum tape, washers, grease, or sealant, depending on the metals involved.

2A-9 D06A

Joggles in removed rivet shanks would indicate partial

- A — bearing failure.
- B — torsion failure.
- C — shear failure.

Answer C. JSAT 2-5 (AC65-15A)

When rivets are to be inspected which have been critically loaded, but show no visible signs of distortion, some of the rivet heads should be drilled off. If, upon examination, the shank appears joggled and the holes in the sheet are misaligned, the rivet has failed in shear.

2A-10 D06A

What type loads cause the most rivet failures?

- A — Shear.
- B — Head.
- C — Bearing.

Answer A. JSAT 2-5, JSAT 2-51 (AC65-15A)
Shear failure is perhaps the most common of rivet failures. It is simply a breakdown of the rivet shank by forces acting along the plane of two adjacent sheets, causing a slipping action which may be severe enough to cut the rivet shank in two. If the shank becomes loaded beyond the yield point of the material and remains overloaded, a permanent shift is established in the sheets and the rivet shank may become joggled.

2A-11 D07A

You can distinguish between aluminum and aluminum alloy by

- A — testing with a 10 percent solution of caustic soda.
- B — filing the metal.
- C — testing with an acetic acid solution.

Answer A. (AC43.13-1B AC65-9A)

Aluminum alloy sheets are marked with the specification number on approximately every square foot of material. If for any reason this identification is not on the material, it is possible to separate the heat-treatable alloys from the non-heat-treatable alloys by immersing a sample of the material in a 10% solution of caustic soda. The heat-treatable alloys will turn black due to the copper content.

2A-12 E05A

Annealing of aluminum

- A — increases the tensile strength.
- B — makes the material brittle.
- C — removes stresses caused by forming.

Answer C. JSAT 2-9 (AC65-9A)

When aluminum alloy is being formed, it will become strain hardened, and often before the forming can be completed, the metal must be annealed to relieve the stress.

SECTION B

SHEET METAL TOOLS AND FASTENERS

The second section of Chapter 2 covers rivet and other special sheet metal fastener nomenclature. Drills and other sheet metal tools are also covered in this section.

2B-1 D01A

A main difference between Lockbolt/Huckbolt tension and shear fasteners (other than their application) is in the

- A — method of installation.
- B — number of locking collar grooves.
- C — shape of the head.

Answer B. JSAT 2-45

Huckbolts and Lockbolts are manufactured to the same Federal Standard. In each case, the tension-type has 4 to 5 locking grooves and the shear-type has 2.

2B-2 D01A

One of the main advantages of Hi-Lok type fasteners over earlier generations is that

- A — the squeezed on collar installation provides a more secure, tighter fit.
- B — they can be removed and reused again.
- C — they can be installed with ordinary hand tools.

Answer C. JSAT 2-45

The hand tools used for installation of Hi-Loks are an open end wrench and hex key (Allen wrench).

2B-3 D01A

Alloy 2117 rivets are heat treated

- A — to a temperature of 910 to 930°F and quenched in cold water.
- B — by the manufacturer and do not require heat treatment before being driven.
- C — by the manufacturer but require reheat treatment before being driven.

Answer B. JSAT 2-38 (AC65-9A)

The 2117-T rivet, known as the field rivet, is used more than any other for riveting aluminum alloy structures. The field rivet is in wide demand because it is ready for use as received, and needs no further heat treating or annealing.

2B-4 D01A

The markings on the head of a Dzus fastener identify the

- A — manufacturer and type of material.
- B — body type, head diameter, and type of material.
- C — body diameter, type of head, and length of the fastener.

Answer C. JSAT 2-49 (AC65-9A)

When working with Dzus fasteners, it is worthwhile to know that the body diameter, length, and head type may be identified by the markings found on the head of the stud.

2B-5 D01A

The Dzus turnlock fastener consists of a stud, grommet, and receptacle. The stud length is measured in

- A — sixteenths of an inch.
- B — tenths of an inch.
- C — hundredths of an inch.

Answer C. JSAT 2-50 (AC65-9A)

The length of a Dzus fastener is measured in hundredths of an inch and is the distance from the head of the stud to the bottom of the spring hole.

2B-6 D01A

The Dzus turnlock fastener consists of a stud, grommet, and receptacle. The stud diameter is measured in

- A — sixteenths of an inch.
- B — hundredths of an inch.
- C — tenths of an inch.

Answer A. JSAT 2-50 (AC65-9A)

The diameter of a Dzus fastener is always measured in sixteenths of an inch.

2B-7 D01A

Threaded rivets (Rivnuts) are commonly used to

- A — join two or more pieces of sheet metal where shear strength is desired.
- B — join two or more pieces of sheet metal where bearing strength is desired.
- C — attach parts or components with screws to sheet metal.

Answer C. JSAT 2-48

Rivnuts are a combination of rivet and nut. A hole is drilled through the skin and the Rivnut, which resembles a hollow rivet with threads inside its shank, is slipped into the hole and upset with a special puller.

2B-8 D01A

Cherrymax and Olympic-Lok rivets

- A — may be installed with ordinary hand tools.
- B — utilize a pulling tool for installation.
- C — utilize a rivet gun, special rivet set, and bucking bar for installation.

Answer B. JSAT 2-41

Both Cherrymax and Olympic Lock rivets require special pulling type tools for installation.

2B-9 D05A

Select the alternative which best describes the function of the flute section of a twist drill.

- A — Forms the cutting edges of the drill point.
- B — Forms the area where the drill bit attaches to the drill motor.
- C — Prevents overheating of the drill point.

Answer C. JSAT 2-27 (AC65-9A)

The flutes are the valley between the lands. They provide a method for cooling oil to reach the cutting edges or lips.

2B-10 D05A

What should be the included angle of a twist drill for soft metals?

- A — 118°.
- B — 90°.
- C — 65°.

Answer B. JSAT 2-27

An included angle of 90 degrees should be used for drilling soft metals such as lead, copper, or very soft aluminum and other soft materials such as plastic.

2B-11 D05A

When comparing the machining techniques for stainless steel sheet material to those for aluminum alloy sheet, it is normally considered good practice to drill the stainless steel at a

- A — higher speed with less pressure applied to the drill.
- B — lower speed with less pressure applied to the drill.
- C — lower speed with more pressure applied to the drill.

Answer C. JSAT 2-27 (AC65-15A)

When drilling hard metals such as titanium or stainless steel, the included angle should be 140° and the operator should use a slower drill speed and a higher pressure on the bit than would be used for aluminum or steel.

2B-12 D05A

When drilling stainless steel, the drill used should have an included angle of

- A — 140° and turn at a low speed.
- B — 118° and turn at a high speed.
- C — 90° and turn at a low speed.

Answer A. JSAT 2-27

When drilling hard metals such as titanium or stainless steel, the included angle should be 140° and the operator should use a slower drill speed and a higher pressure on the bit than would be used for aluminum or steel.

2B-13 D05A

Which is correct concerning the use of a file?

- A — A smoother finish can be obtained by using a double cut file than by using a single cut file.
- B — Apply pressure on the forward stroke, only, except when filing very soft metals such as lead or aluminum.
- C — The terms “double cut” and “second cut” have the same meaning in reference to files.

Answer B. JSAT 2-21 (AC65-9A)

Files which have one row of teeth are known as “single-cut”, and those with two rows of teeth as “double-cut”. The coarseness of the teeth are rated from coarse to fine: Coarse cut, bastard cut, second cut, smooth cut, and dead smooth cut. Generally speaking, double cut files are used for removing the most material. When cutting with the file, one should apply pressure only on the forward cut, unless the material is soft. In this case the file may be permitted to remain in contact with the material on the return to help remove chips from the teeth.

2B-14 D05A

Which procedure is correct when using a reamer to finish a drilled hole to the correct size?

- A — Turn the reamer only in the cutting direction.
- B — Apply considerable pressure on the reamer when starting the cut and reduce the pressure when finishing the cut.
- C — Turn the reamer in the cutting direction when enlarging the hole and in the opposite direction to remove from the hole.

Answer A. JSAT 9-19 (AC65-9A)

When a reamer is being used, it should be rotated in the cutting direction only. The reamer should be turned steadily and evenly to prevent chattering or marking and scoring of the walls.

2B-15 D05A

What should be the included angle of a twist drill for hard metal?

- A — 118°
- B — 90°
- C — 100°

Answer A. JSAT 2-27 (AC65-9A)

For most drilling, a twist drill with a cutting angle of 118° will be sufficient; however, when drilling soft metals, a cutting angle of 90° may be more efficient.

2B-16 D05A

(Refer to Airframe figure 1) Which of the rivets shown will accurately fit the conical depression made by a 100° countersink?

- A — 3.
- B — 2.
- C — 1.

Answer C. JSAT 2-36

When a rivet has a 100° countersunk head, it has a head whose sides form a 100° angle. In choice “A” for this question, there are 260° of angle shown, if you don’t include the rivet’s head. This leaves 100° for the head of the rivet.

2B-17 D06A

The identifying marks on the heads of aluminum alloy rivets indicate the

- A — degree of dimensional and process control observed during manufacture.
- B — specific alloy used in the manufacture of the rivets.
- C — head shape, shank size, material used, and specifications adhered to during manufacture.

Answer B. JSAT 2-38 (AC65-9A)

Markings on the heads of rivets are used to classify their characteristics. The different markings indicate the composition of the rivet stock.

2B-18 D06A

When an MS20470D rivet is installed, its full shear strength is obtained

- A — by the cold working of the rivet metal in forming a shop head.
- B — only after a period of age hardening.
- C — by heat treating just prior to being driven.

Answer B. JSAT 2-38

The “D” and “DD” series rivets are known as “ice-box” rivets because they must be stored at low temperatures after heat-treating. The low temperature storage retards the naturally occurring age hardening that occurs in the 2017 and 2024 alloys following heat-treating. Within minutes after removal from refrigeration, these rivets will begin to age harden. These rivets will only achieve their full strength after the age hardening process is complete.

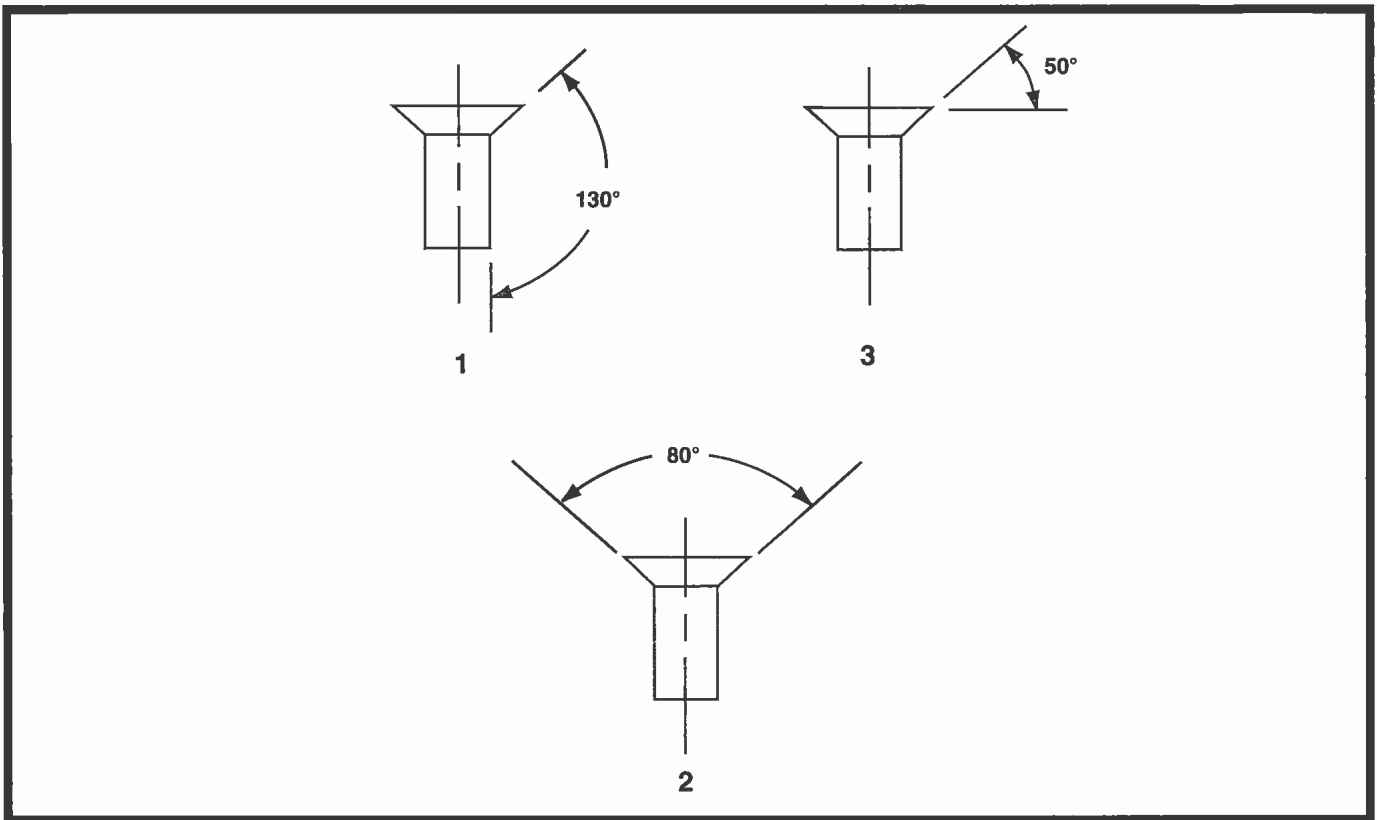


Figure 1. — Rivets

2B-19 D06A

What is the purpose of refrigerating 2017 and 2024 aluminum alloy rivets after heat treatment?

- A — To retard age hardening.
- B — To relieve internal stresses.
- C — To accelerate age hardening.

Answer A. JSAT 2-38 (AC65-9A)

When an aluminum alloy is heated to a specific temperature and quenched in water or in brine, it will not get hard immediately as steel does, but will gradually become hard and gain its full strength. Rivets made of an alloy such as 2017 can have their aging process retarded by storing them in a refrigerator.

2B-20 D06A

Under certain conditions, type A rivets are not used because of their

- A — low strength characteristics.
- B — tendency toward embrittlement when subjected to vibration.
- C — high alloy content.

Answer A. JSAT 2-38 (AC65-9A)

The 1100 rivet, which is composed of 99.45% pure aluminum, is very soft. It is generally used for riveting non-structural parts.

2B-21 D06A

Heat treated rivets in the D and DD series that are not driven within the prescribed time after heat treatment or removal from refrigeration

- A — may be returned to refrigeration and used later without reheat treatment.
- B — must be reheat treated before use.
- C — must be discarded.

Answer B. JSAT 2-39 (AC65-9A)

Rivets classed as "D" and "DD" become hard within a few hours of being heat treated. If this happens, they must be heat treated again before they can be used.

2B-22 D06A

The dimensions of an MS20430AD-4-8 rivet are

- A — 1/8 inch in diameter and 1/2 inch long.
- B — 1/8 inch in diameter and 1/4 inch long.
- C — 4/16 inch in diameter and 8/32 inch long.

Answer A. JSAT 2-36

The first number following the letter (material code) indicates the diameter of the rivet in 1/32 inch increments. $4/32 = 1/8$ inch diameter. The number following the dash is the length in 1/16 inch increments. $8/16 = 1/2$ inch.

2B-23 D06A

Most rivets used in aircraft construction have

- A — a raised dot.
- B — smooth heads without markings.
- C — dimples.

Answer C. JSAT 2-38 (AC65-9A)

There are more rivets made of 2117 alloy than any other. These rivets are identified by a single dimple on their head.

2B-24 D06A

MS20426AD-6-5 indicates a countersunk rivet which has

- A — an overall length of 5/16 inch.
- B — a shank length of 5/16 inch (excluding head).
- C — a shank length of 5/32 inch (excluding head).

Answer A. JSAT 2-36 (AC65-9A)

The second dash number indicates the rivet's length in sixteenths of an inch. In this case, it is 5/16 inch.

2B-25 D06A

Which rivet may be used as received without further treatment?

- A — 2117-T3.
- B — 2017-T3.
- C — 2024-T4.

Answer A. JSAT 2-38 (AC65-9A)

The reason the 2117-T rivet is so popular is that it is ready for use as received, and needs no further heat treating or annealing. It also has a high resistance to corrosion.

2B-26 D06A

A DD rivet is heat treated before use to

- A — soften to facilitate riveting.
- B — harden and increase strength.
- C — relieve internal stresses.

Answer A. JSAT 2-39 (AC65-9A)

A "DD" rivet is made from 2024-T aluminum alloy. These rivets are stored in a refrigerator until used. They may be heat treated just before use to soften them, which makes the riveting easier.

2B-27 D06A

Which rivet is used for riveting magnesium alloy structures?

- A — 5056 aluminum.
- B — Monel.
- C — Mild steel.

Answer A. JSAT 2-38 (AC65-9A)

The 5056 rivet is used for riveting magnesium alloy structures because of its corrosion resistant qualities in combination with magnesium.

2B-28 D06A

Which rivet is used for riveting nickel steel alloys?

- A — Mild steel.
- B — Monel.
- C — 2024 aluminum.

Answer B. JSAT 2-39 (AC65-9A)

Monel rivets are used for riveting nickel/steel alloys. They can be substituted for those made of corrosion-resistant steel in some cases.

2B-29 D06A

(Refer to Airframe figure 3) Which is the grip length of the flush rivet?

- A — 2.
- B — 3.
- C — 1.

Answer B. JSAT 2-36 (AC65-15A)

The grip length of a rivet is that portion of the rivet which is passing through the material.

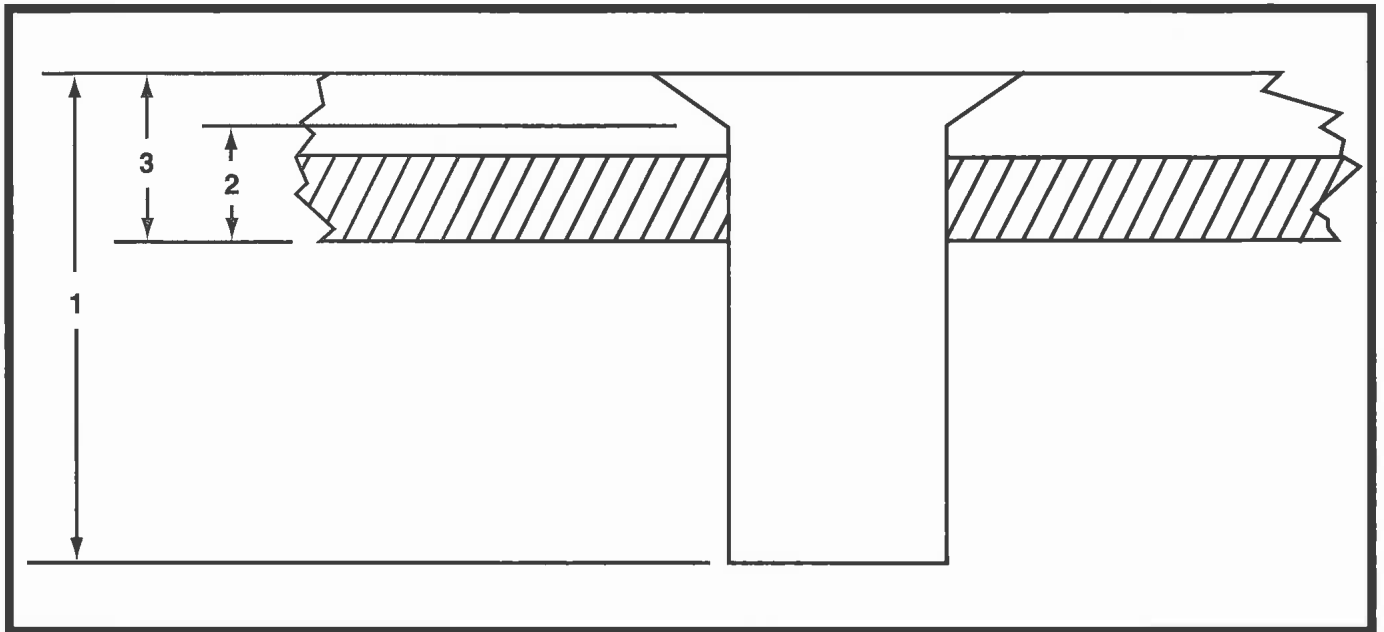


Figure 3. — Grip Length

SECTION C SHEET METAL FABRICATION

Section C of Chapter 2 includes information regarding sheet metal construction and repairs, layout and fabrication computations, riveting, and rivet layout processes.

2C-1 D01A

A well designed rivet joint will subject the rivets to

- A — compressive loads.
- B — tension loads.
- C — shear loads.

Answer C. JSAT 2-51 (AC65-15A)

Rivets hold pieces of aircraft skin together, and in a properly designed riveted joint, the rivets support shear loads only.

2C-2 D01A

The general rule for finding the proper rivet diameter is

- A — three times the thickness of the thickest sheet.
- B — two times the rivet length.
- C — three times the thickness of the materials to be joined.

Answer A. JSAT 2-52 (AC65-15A)

As a general rule, the rivet diameter should be not less than three times the thickness of the thickest sheet being riveted.

2C-3 D01A

The shop head of a rivet should be

- A — one and one-half times the diameter of the rivet shank.
- B — one and one-half times the diameter of the manufactured head of the rivet.
- C — one-half times the diameter of the rivet shank.

Answer A. JSAT 2-53

A properly formed shop head is one-half the shank diameter high, its diameter is one-and-one-half times that of the shank, and it is concentric with the hole.

2C-4 D05A

How many MS20470 AD-4-6 rivets will be required to attach a 10 x 5 inch plate, using a single row of rivets, minimum edge distance, and 4D spacing?

- A — 54.
- B — 56.
- C — 52.

Answer B. JSAT 2-55 (AC43.13-1B)

The rivets identified in this question are 4/32" in diameter. Minimum edge distance, according to the AC43.13-1B, is two times the diameter. This gives an edge distance of 1/4 inch. One-fourth of an inch taken away from each side of the plate leaves the dimensions as 4-1/2" by 9-1/2". With four times the rivet diameter spacing, the spacing will be 1/2 inch. Because the plate has two 4-1/2" sides and two 9-1/2" sides (in terms of rivet installation), there are 28 inches total to be covered, with 1/2" spacing, or 56 rivets needed.

2C-5 D05A

A single lap sheet splice is to be used to repair a section of damaged aluminum skin. If a double row of 1/8-inch rivets is used, the minimum allowable overlap will be

- A — 3/4 inch.
- B — 13/16 inch.
- C — 1/2 inch.

Answer B. JSAT 2-53 (AC65-15A)

The minimum edge distance when riveting is two times the diameter of the rivet, which in this case is 1/4". Because this is an overlap splice, there are two edge distances involved, or a total of 1/2". The minimum pitch, or distance between rivets, should be no less than three times the diameter. The transverse pitch, or distance between rows, should be about 75% of the pitch. In this case, 75% of 3/8" is 9/32". The edge distance total of 1/2", and the transverse pitch of 9/32", gives a total of 25/32" minimum overlap. The only answer that gives at least this overlap is 13/16 inch.

2C-6 D05A

What is the minimum edge distance for aircraft rivets?

- A — Three times the diameter of the rivet shank.
- B — Two times the diameter of the rivet head.
- C — Two times the diameter of the rivet shank.

Answer C. JSAT 2-53 (AC65-15A)

If rivets are too close to the edge, the sheet is likely to tear, but if they are too far back, the edge of the sheet will lift. Accepted practice is to have an edge distance of no less than two times the diameter of the rivet.

2C-7 D05A

What is the minimum spacing for a single row of aircraft rivets?

- A — Three times the length of the rivet shank.
- B — Three times the diameter of the rivet shank.
- C — Two times the diameter of the rivet shank.

Answer B. JSAT 2-54 (AC65-15A)

The minimum spacing, or pitch, for a single row of rivets is three times the diameter of the rivet shank.

2C-8 D05A

What is one of the determining factors which permits machine countersinking when flush riveting?

- A — Thickness of the material and rivet diameter are the same.
- B — Thickness of the material is greater than the thickness of the rivet head.
- C — Thickness of the material is less than the thickness of the rivet head.

Answer B. JSAT 2-58 (AC65-15A)

As a general rule, use the drill or machine countersink method when the thickness of the material is greater than the thickness of the rivet head. If the material is too thin, drill or machine countersinking will grind away too much of the material. In this case, dimpling should be used.

2C-9 D05A

Aircraft structural units, such as spars, engine supports, etc., which have been built up from sheet metal, are normally

- A — repairable, using approved methods.
- B — not repairable, but must be replaced when damaged or deteriorated.
- C — repairable, except when subjected to compressive loads.

Answer A. JSAT 2-51 (AC43.13-1B)

Aircraft structural units, which are made from sheet metal, are generally repairable if the repair procedures used bring the aircraft back to an airworthy condition, and meet the requirements of the Federal Aviation Administration.

2C-10 D05A

A factor which determines the minimum space between rivets is the

- A — diameter of the rivets being used.
- B — length of the rivets being used.
- C — thickness of the material being riveted.

Answer A. JSAT 2-54 (AC65-15A)

Rivet spacing, known as pitch, is determined by the diameter of the rivets being used.

2C-11 D05A

Rivet gauge, or transverse pitch is the distance between the

- A — heads of rivets in the same row.
- B — centers of rivets in adjacent rows.
- C — centers of adjacent rivets in the same row.

Answer B. JSAT 2-54

The distance between the rows of rivets in a multi-row layout should be about 75% of the pitch, and the rivets in adjacent rows should be staggered.

2C-12 D05A

Rivet pitch is the distance between the

- A — centers of adjacent rivets in the same row.
- B — heads of rivets in the same row.
- C — centers of rivets in adjacent rows.

Answer A. JSAT 2-54

The distance between adjacent rivets in a row is called the pitch of the rivet.

2C-13 D05A

(Refer to Airframe figure 2) Select the preferred drawing for proper countersinking.

- A — 2.
- B — 1.
- C — All are acceptable.

Answer B. JSAT 2-60 (AC65-15A)

In order to insure that a countersunk rivet has sufficient bearing strength, the thickness of the sheet that is to be countersunk must be at least as thick as the depth of the rivet head (#2 in figure 2). However, it is preferable to have the skin thicker than the depth of the rivet head (#1 in figure 2).

2C-14 D06A

Which of the following need not be considered when determining minimum rivet spacing?

- A — Rivet length.
- B — Type of material being riveted.
- C — Rivet diameter.

Answer A. JSAT 2-54 (AC65-15A)

The length of the rivet has no effect on the rivet spacing.

2C-15 D06A

A rivet set used to drive MS20470 rivets should

- A — be nearly flat on the end, with a slight radius on the edge to prevent damage to the sheet being riveted.
- B — have a slightly greater radius than the rivet head.
- C — have the same radius as the rivet head.

Answer B. JSAT 2-64

The radius of the cup of the rivet set must be slightly larger than the radius of the rivet head. If it is too small, it will produce a small indentation on the head of the rivet. If it is too large, it will produce the same indentation on the skin around the rivet.

2C-16 D06A

A sheet metal repair is to be made using two pieces of 0.040-inch aluminum riveted together. All rivet holes are drilled for 3/32 inch rivets. The length of the rivets to be used will be

- A — 5/16 inch.
- B — 1/4 inch.
- C — 1/8 inch.

Answer B. JSAT 2-52 (AC43.13-1B)

To properly form a rivet shop head, the rivet length (L) should be equal to the thickness of the metal being joined (grip) plus one and one-half times the diameter (D) of the rivet or ($L = \text{Grip} + 1.5 \times D$). Substituting the values from the question into the formula we get $L = (.040 + .040) + 1.5 \times 3/32$ or approximately .221". Standard rivet lengths are in increments of 1/32", and the closest standard length is .25" or 1/4".

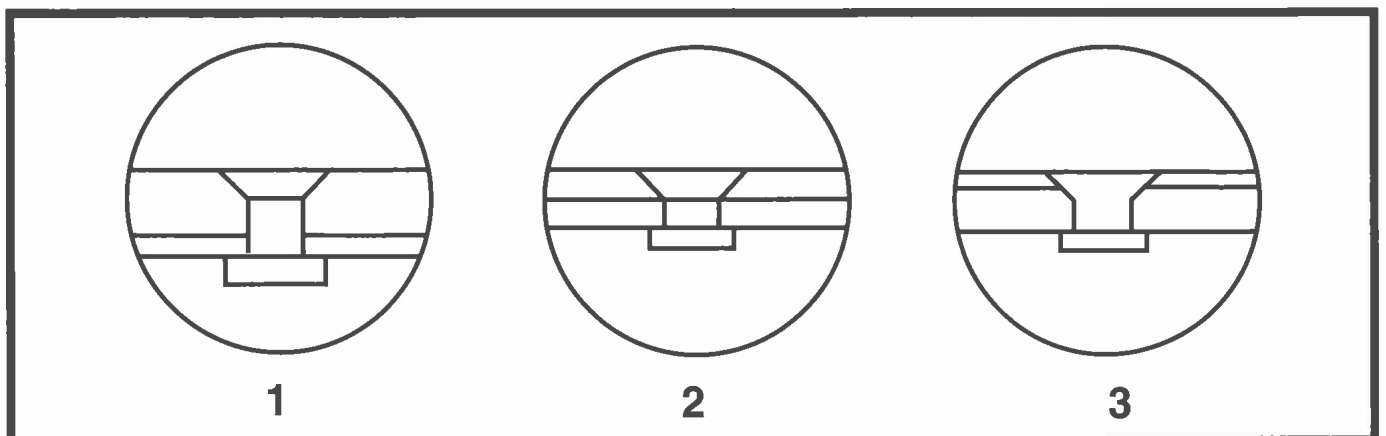


Figure 2. — Countersinking

2C-17 D06A

Which rivets should be selected to join two sheets of .032-inch aluminum?

- A — MS20455DD-5-3.
- B — MS20425D-4-3.
- C — MS20470AD-4-4.

Answer C. JSAT 2-52 (AC65-15A)

To join the two pieces of aluminum together, the rivet will need to be .064" long plus 1-1/2 times its diameter. The AN470AD-4-4 rivet is 1/8" in diameter and 1/4" long. This rivet meets the length requirement.

2C-18 D06A

A sheet metal repair is to be made using two pieces of 0.0625-inch aluminum riveted together. All rivet holes are drilled for 1/8 inch rivets. The length of the rivets to be used will be

- A — 5/16 inch.
- B — 3/16 inch.
- C — 5/32 inch.

Answer A. JSAT 2-52 (AC43.13-1B)

To find the rivet shank length, add the material thickness and then add 1-1/2 times the rivet diameter. The material required to form the shop head is .3125" or 5/16" total shank length.

2C-19 D06A

The length of a rivet to be used to join a sheet of .032 inch and .064 inch aluminum alloy should be equal to

- A — one and one half times the rivet diameter plus .096 inch.
- B — three times the rivet diameter plus .096 inch.
- C — two times the rivet diameter plus .064 inch.

Answer A. JSAT 2-52 (AC65-15A)

When determining total rivet length, the combined thickness of the materials to be joined must be known. This measurement is grip length. The total length of the rivet must be grip length plus 1-1/2 times the diameter of the rivet shank (necessary to form a shop head on the rivet).

2C-20 D06A

What is generally the best procedure to use when removing a solid shank rivet?

- A — Drill to the base of the manufactured rivet head with a drill one size smaller than the rivet shank and remove the rivet with a punch.
- B — Drill through the manufactured head and shank with a drill one size smaller than the rivet and remove the rivet with a punch.
- C — Drill through the manufactured head and shank with a shank size drill and remove the rivet with a punch.

Answer A. JSAT 2-67

Using a drill one size smaller than the shank of the rivet, and drilling only through the head should prevent enlarging the rivet hole.

2C-21 D06A

The length of rivet to be chosen when making a structural repair that involves the joining of 0.032 inch and 0.064 inch aluminum sheet, drilled with a No. 30 drill, is

- A — 1/4 inch
- B — 7/16 inch
- C — 5/16 inch

Answer C. JSAT 2-52

The length of rivet to use is determined by adding together the thickness of the material, and then adding 1-1/2 times the diameter of the rivets to this value. The thickness of the material in this case is .096". A No. 30 drill is .1285" diameter, which would take a 1/8" diameter rivet. One and one-half times the rivet diameter, or 3/16", plus the thickness of the material, would call for a rivet 5/16" in length.

2C-22 D07A

If a streamline cover plate is to be hand formed using a form block, a piece of dead soft aluminum should first be placed over the hollow portion of the mold and securely fastened in place. The bumping operation should be

- A — started by tapping the aluminum lightly around the edges and gradually working down into the center.
- B — distributed evenly over the face of the aluminum at all times rather than being started at the edges or center.
- C — started by tapping the aluminum in the center until it touches the bottom of the mold and then working out in all directions.

Answer A. JSAT 2-80 (AC65-15A)

With a bumping block clamped in a bench vise, a soft-faced mallet or hard-wood drive block and suitable mallet should be used to start the bumping action. With light blows of the mallet, work the material down gradually from the edges. The object of the bumping process is to work the material into shape by stretching it, rather than by forcing it into the form with heavy blows. Always start bumping near the edge of the form; never start near the center of the blister.

2C-23 D07A

A piece of flat stock that is to be bent to a closed angle of 15° must be bent through an angle of

- A — 165° .
- B — 105° .
- C — 90° .

Answer A. JSAT 2-71 (AC65-15A)

When a closed angle is referred to, it means an angle that is formed by taking a flat piece of stock and bending it past 90° , to where the two ends of the stock start coming together. Because there are 180° in a piece of flat stock, to end up with a closed angle of 15° would require a bend of 165° .

2C-24 D07A

When a piece of aluminum alloy is to be bent using a minimum radius for the type and thickness of material,

- A — less pressure than usual should be applied with the movable (upper) clamping bar.
- B — the layout should be made so that the bend will be 90° to the grain of the sheet.
- C — the piece should be bent slowly to eliminate cracking.

Answer B. JSAT 2-69 (AC65-15A)

The sheet metal we use for aircraft construction and repair was formed from an ingot of aluminum alloy passed through a series of rollers until it was reduced to the thickness needed. In the process of rolling, the metal assumes a grain structure which is easy to see in a piece of sheet aluminum alloy. When laying out a pattern, the bends in the metal should be made across the grain as much as possible.

2C-25 D07A

The flat layout or blank length of a piece of metal from which a simple L shaped bracket 3 inches by 1 inch is to be bent depends upon the radius of the desired bend. The bracket which will require the greatest amount of material is one which has a bend radius of

- A — $1/2$ inch.
- B — $1/4$ inch.
- C — $1/8$ inch.

Answer C. JSAT 2-69 (AC65-15A)

The smaller the bend radius in an L-shaped bracket, the greater the amount of material needed to make the bracket. If the bracket is made from $1/8$ " sheet metal, with a bend radius of $1/8$ ", the flat layout would need to be 3.742" long. As the bend radius becomes greater, the length of the flat layout becomes less.

2C-26 D07A

If it is necessary to compute a bend allowance problem and bend allowance tables are not available, the neutral axis of the bend can be

- A — found by adding approximately one half of the stock thickness to the bend radius.
- B — represented by the actual length of the required material for the bend.
- C — found by subtracting the stock thickness from the bend radius.

Answer A. JSAT 2-70 (AC65-15A)

The line along which the portion of sheet being bent does not shrink or stretch is called the neutral axis of the metal. It is not located exactly in the center of the sheet, but is actually about 44.5% of the sheet thickness from the inside of the bend. For practical purposes, we can consider this to be in the center.

2C-27 D07A

Unless otherwise specified, the radius of a bend is the

- A — radius of the neutral axis plus one half the thickness of the metal being formed.
- B — inside radius of the metal being formed.
- C — inside radius plus one half the thickness of the metal being formed.

Answer B. JSAT 2-70 (AC65-15A)

The radius of a bend on a sheet of material is the distance from the intersection of the bend tangent lines to the inside of the bend, or it is the radius measured on the inside curve of the material.

2C-28 D07A

The sharpest bend that can be placed in a piece of metal without critically weakening the part is called the

- A — minimum radius of bend.
- B — bend allowance.
- C — maximum radius of bend.

Answer A. JSAT 2-70 (AC65-15A)

The radius of bend of a sheet of material is the radius of the bend as measured on the inside of the curved material. The minimum radius of bend of a sheet of material is the sharpest curve, or bend, to which the sheet can be bent without critically weakening the metal at the bend.

2C-29 D07A

The most important factors needed to make a flat pattern layout are

- A — radius, thickness, and mold line.
- B — the lengths of the legs (flat sections).
- C — radius, thickness, and degree of bend.

Answer C. JSAT 2-70 (AC65-15A)

In order to make a flat pattern layout, the technician must know the radius of the bend, because this must be accounted for when calculating bend allowance. The thickness of the material is needed so the technician can calculate the setback, and thickness is also accounted for in calculating bend allowance. The degree of bend is also needed when calculating bend allowance.

2C-30 D07A

A piece of sheet metal is bent to a certain radius. The curvature of the bend is referred to as the

- A — bend radius.
- B — bend allowance.
- C — neutral line.

Answer A. JSAT 2-70 (AC65-15A)

The bend radius for a piece of sheet metal is the distance from the intersection of the bend tangent lines to the inside of the bend or it is the measure of the inside curve of the bend.

2C-31 D07A

The purpose of a joggle is to

- A — decrease the weight of the part and still retain the necessary strength.
- B — increase obstruction for a sheet or an extrusion.
- C — allow clearance for a sheet or an extrusion.

Answer C. JSAT 2-82 (AC65-15A)

A joggle is an offset formed on an angle strip to allow clearance for a sheet or an extrusion.

2C-32 D07A

When bending metal, the material on the outside of the curve stretches while the material on the inside of the curve compresses. That part of the material which is not affected by either stress is the

- A — mold line.
- B — bend tangent line.
- C — neutral line.

Answer C. JSAT 2-70 (AC65-15A)

Bending a strip compresses the material on the inside of the curve and stretches the material on the outside of the curve. However, at some distance between these two extremes lies a space which is not affected by either force. This is known as the neutral line or neutral axis.

2C-33 D07A

The sight line on a sheet metal flat layout to be bent in a cornice or box brake is measured and marked

- A — one radius from either bend tangent line.
- B — one-half radius from either bend tangent line.
- C — one radius from the bend tangent line that is placed under the brake.

Answer C. JSAT 2-75

The sight line is a line that is made on a piece of metal to indicate where the metal is to be placed in a brake (the sight line is placed directly under the nose of the radius rod). To allow for the stretch of the metal it is placed one radius away from the bend tangent line that is placed under the brake shoe.

2C-34 D07A

On a sheet metal fitting layout with a single bend, allow for stretching by

- A — adding the setback to each leg.
- B — subtracting the setback from one leg.
- C — subtracting the setback from both legs.

Answer C. JSAT 2-71 (AC65-15A)

When accounting for the total flat layout dimension when the object has a single bend, the two flats forming the bend must both have the setback subtracted from their mold line dimension, and then the bend allowance is added in.

2C-35 D07A

(Refer to Airframe figure 4) The length of flat A is

- A — 3.875 inches.
- B — 3.937 inches.
- C — 3.750 inches.

Answer C. JSAT 2-71 (AC65-15A)

The length of flat "A" is equal to the total length from the mold point to the end of the flat, or 4", minus the setback. The setback for a 90° bend is equal to the metal thickness plus the radius of the bend. The thickness of the metal, .0625" or 1/16", plus the bend radius of 3/16", is equal to 1/4". Four inches minus 1/4" leaves a flat of 3.75".

2C-36 D07A

(Refer to Airframe figure 4) The amount of material required to make the 90° bend is

- A — 0.3717 inch.
- B — 0.3925 inch.
- C — 0.3436 inch.

Answer C. JSAT 2-73 (AC65-15A)

The amount of material required to make the bend is known as the bend allowance. The bend allowance for a 90° may be calculated using the formula given in the drawing. Simply substitute 3.14 for π , .1875 for R, and .0625 for T. Then complete the calculations.

2C-37 D07A

(Refer to Airframe figure 5) What is the length of flat A?

- A — 3.9 inches.
- B — 3.7 inches.
- C — 3.8 inches.

Answer B. JSAT 2-70 (AC65-15A)

Using the setback formula given in the drawing, substitute .25 for R and .062 for T. Performing the calculation you get .312. To find the flat, subtract the setback from the mold line dimension. Therefore, 4 - .312 = 3.688. Rounding 3.688 to one decimal accuracy we get 3.7.

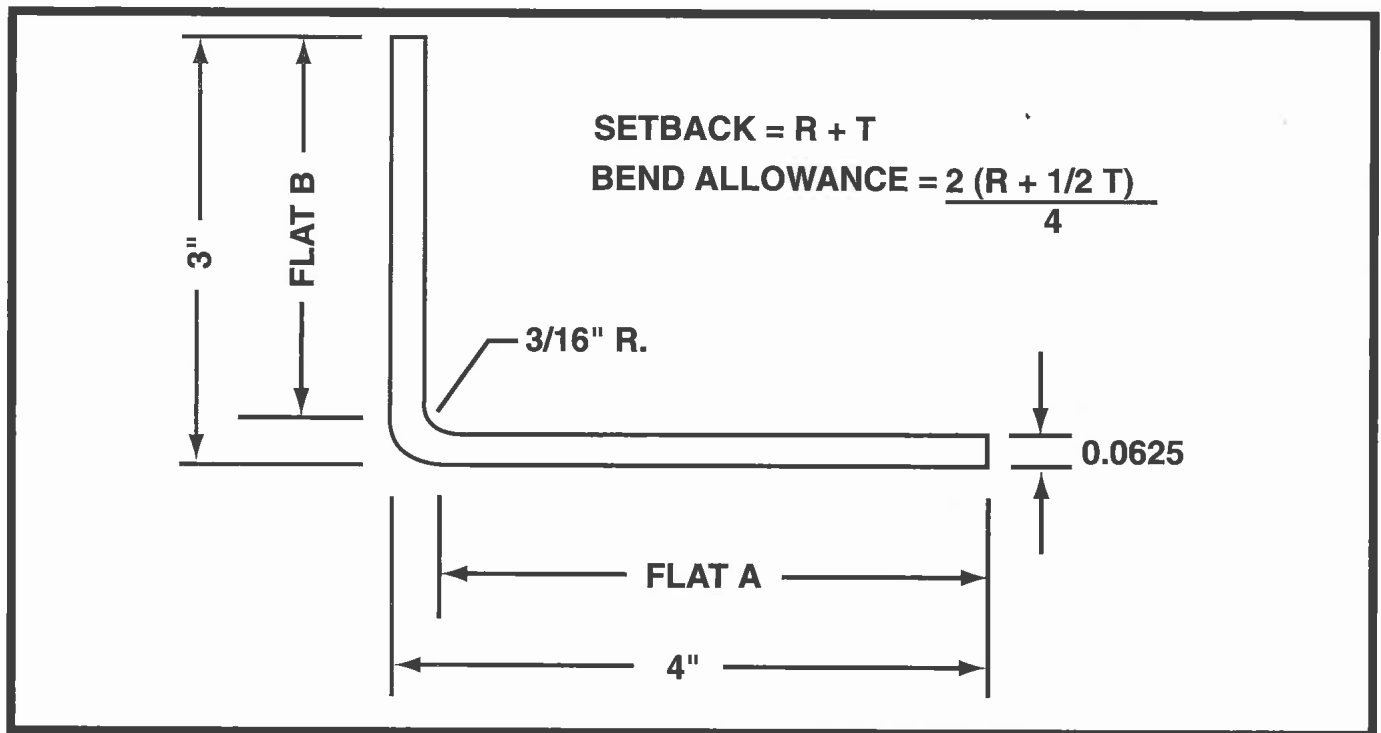


Figure 4. — Bending Sheet Metal

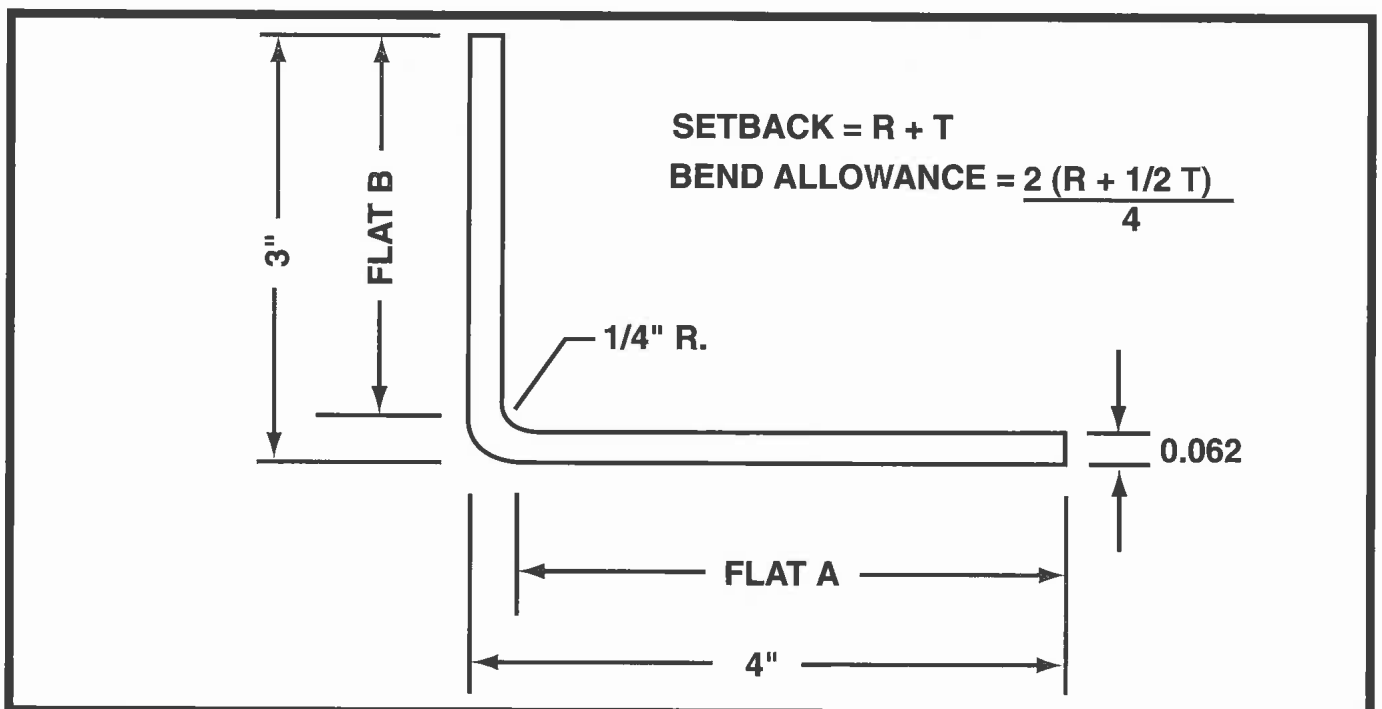


Figure 5. — Sheet Metal Layout

2C-38 D07A

(Refer to Airframe figure 5) What is the flat layout dimension?

- A — 6.6 inches.
- B — 7.0 inches.
- C — 6.8 inches.

Answer C. JSAT 2-70 (AC65-15A)

The flat layout for a 90° bend should be accomplished by the following steps. First calculate the setback using the formula given (.312). Then subtract the setback from the given mold line dimensions. Flat A = $4 - .312 = (3.688)$, Flat B = $3 - .312 = (2.688)$. Then calculate the bend allowance using the formula given (.441). Calculate the sum of the flats and bend allowance to find the flat layout dimension. $(3.688 + .441 + 2.688) = 6.817$ or 6.8

2C-39 D07A

(Refer to Airframe figure 6) Determine the dimensions of A, B, and C in the flat layout. Setback = .252; Bend allowance = .345;

- A — A = 1.252; B = 2.504; C = 1.752
- B — A = .748; B = 2.252; C = 2.004
- C — A = .748; B = 1.496; C = 1.248

Answer C. JSAT 2-70 (AC65-15A)

The dimension for flat "A" is its mold line of 1 minus the setback. The setback is given in this question as .252, so the dimension of flat "A" is .748. The dimension for flat "B" is its mold line of 2 minus two setbacks (one at each end), or 1.496. The dimension of flat "C" is its mold line of 1.5 minus the setback, or 1.248.

2C-40 D07A

(Refer to Airframe figure 6) What is dimension D? Setback = .252; Bend allowance = .345

- A — 3.841
- B — 3.492
- C — 4.182

Answer C. JSAT 2-70 (AC65-15A)

Dimension "D" in this figure is the total flat layout dimension. This dimension would be equal to the three flats "A", "B", and "C", plus two bend allowances for the two bends. The values for the three flats was calculated earlier, and the bend allowance is given in the question as .345. The three flats plus two of the bend allowances would give a total dimension of 4.182.

2C-41 D07A

(Refer to Airframe figure 7) What is dimension F? Setback at D = .095; Setback at E = .068; Bend allowance at D = .150; Bend allowance at E = .112

- A — 4.836
- B — 5.738
- C — 5.936

Answer C. JSAT 2-70 (AC65-15A)

The dimension "F" is the total flat layout for the object. This dimension is going to equal the individual flats "A", plus "B", plus "C", plus the bend allowances at "D" and "E". Keeping in mind that the dimension of a flat is equal to the mold line minus the setback, the following dimensions can be calculated: Flat "A" = $1 - .095$ or .905 Flat "B" = $3 - .095$ and .068 or 2.837 Flat "C" = $2 - .068$ or 1.932 Bend Allowance at "D" = .150 Bend Allowance at "E" = .112. The total of the five dimensions above is 5.936.

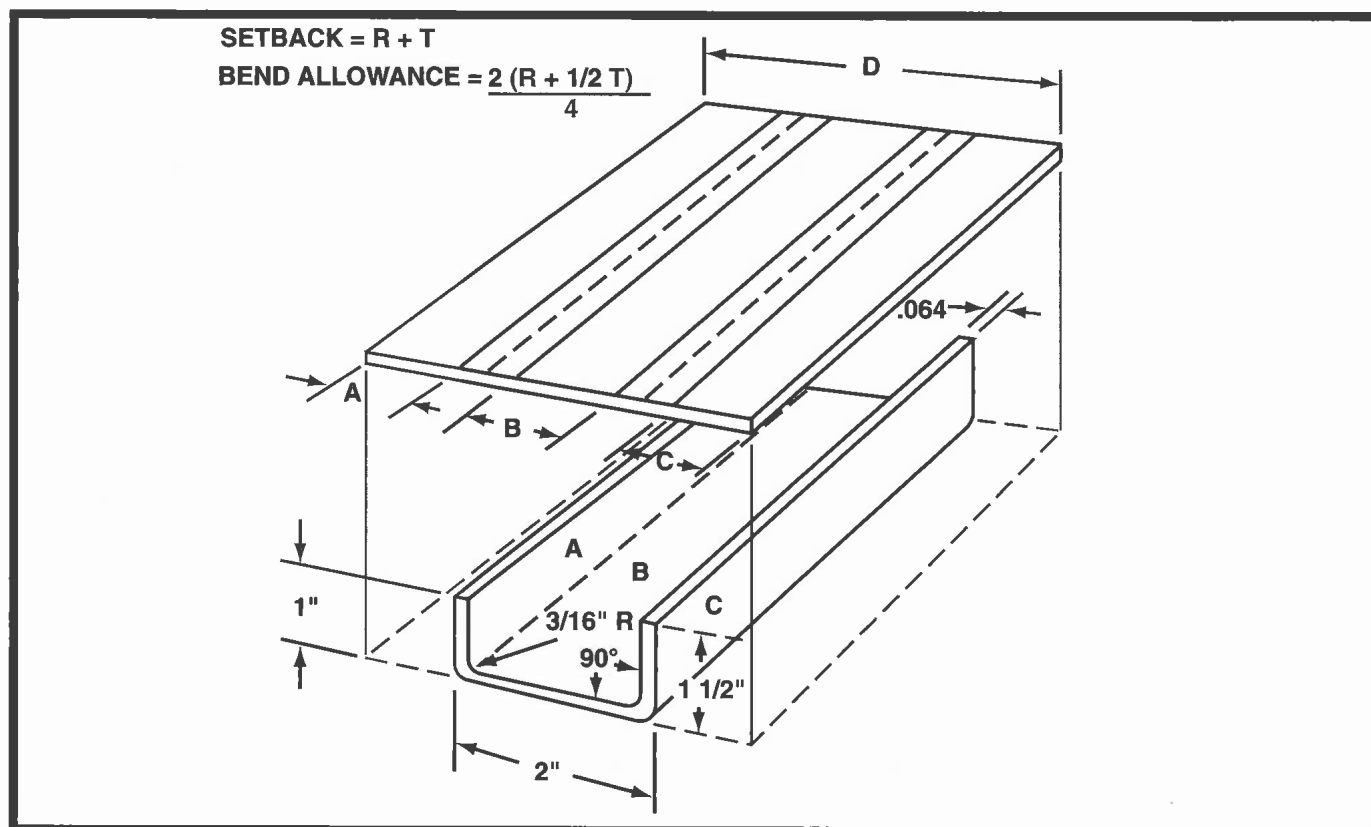


Figure 6. — Sheet Metal Layout

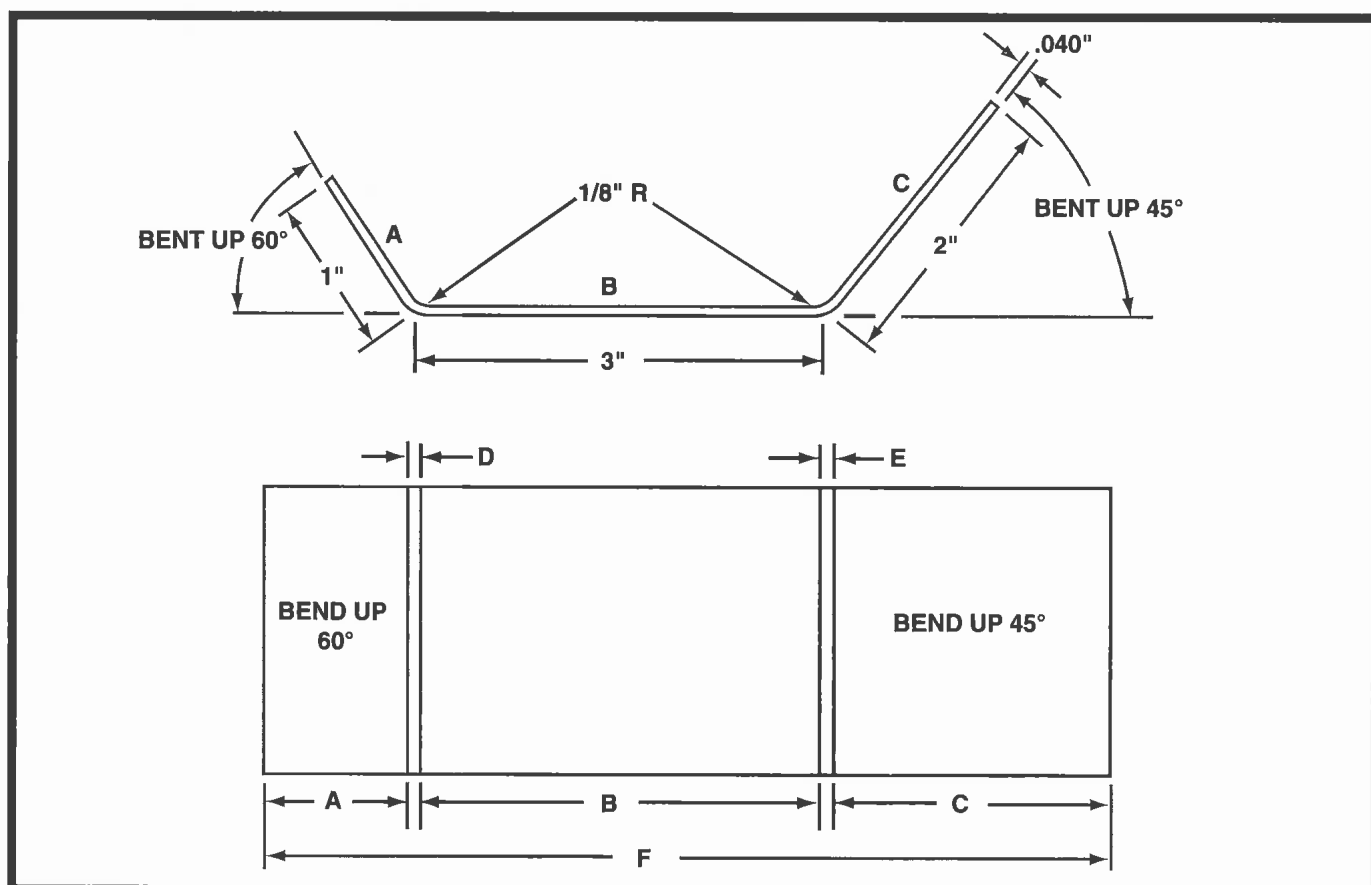


Figure 7. — Sheet Metal Layout

SECTION D

INSPECTION AND REPAIR OF METALLIC AIRCRAFT STRUCTURES

Section D of Chapter 2 includes information regarding sheet metal inspection and repair limitations and nomenclature.

2D-1 D02A

When repairing puncture type damage of a metal faced laminated honeycomb panel, the edges of the doubler should be tapered to

- A — whatever is desired for a neat, clean appearance.
- B — 100 times the thickness of the metal.
- C — two times the thickness of the metal.

Answer B. JSAT 2-13

A doubler should be cut from a piece of aluminum the same thickness as the original face or one and one-half times as thick, and it should be tapered at a ratio of about 100:1. Always refer to the manufacturer's guidelines for repair specifications.

2D-2 D05A

Shallow scratches in sheet metal may be repaired by

- A — buffing.
- B — burnishing.
- C — stop drilling.

Answer B. JSAT 2-84

Scratches in aluminum alloy skins encourage corrosion to form, and concentrate the stresses enough that they may cause the part to crack. If the scratch is not too deep, it can be burnished with a smooth, round-end piece of steel to force the metal back into the scratch.

2D-3 D05A

Which statement is true regarding the inspection of a stressed skin metal wing assembly known to have been critically loaded?

- A — If rivets show no visible distortion, further investigation is unnecessary.
- B — If genuine rivet tipping has occurred, groups of consecutive rivet heads will be tipped in the same direction.
- C — If bearing failure has occurred, the rivet shanks will be jogged.

Answer B. JSAT 2-84 (AC65-15A)

The presence of chipped or cracked paint around the heads of rivets may indicate shifted or loose rivets. If tipped or loose rivet heads are noticed, they will generally show up in groups of several consecutive rivets, and will probably be tipped in the same direction.

2D-4 D05A

Repairs or splices involving stringers on the lower surface of stressed skin metal wings are usually

- A — permitted only if the damage does not exceed 6 inches in any direction.
- B — not permitted.
- C — permitted but are normally more critical in reference to strength in tension than similar repairs to the upper surface.

Answer C. JSAT 2-91 (AC43.13-1B)

Repairs or splices involving stringers are allowed, but it is especially important that care be taken when splicing stringers on the lower surface of stressed skin wings. It is in this area of the wing that very high-tension stresses exist.

2D-5 D05A

When straightening members made of 2024-T4, you should

- A — straighten cold and anneal to remove stress.
- B — straighten cold and reinforce.
- C — apply heat to the inside of the bend.

Answer B. (AC43.13-1B)

Aluminum members which are slightly bent may be straightened cold and examined with a magnifying glass for injury to the material. Reinforce the straightened parts to an extent depending on the condition of the material.

2D-6 D05A

What is indicated by a black “smoky” residue streaming back from some of the rivets on an aircraft?

- A — Fretting corrosion is occurring between the rivets and the skin.
- B — Exfoliation corrosion is occurring inside the structure.
- C — The rivets were excessively work hardened during installation.

Answer A. JSGT 12-13

Fretting corrosion may occur around rivets in a skin, and will be indicated by dark deposits around the rivet heads streaming out behind, give the appearance of “rivet smoking”.

WOOD, COMPOSITE, AND TRANSPARENT PLASTIC STRUCTURES

SECTION A AIRCRAFT WOOD STRUCTURES

This section includes information on aircraft wood structure nomenclature, repairs, inspections, and structural fabrication procedures.

3A-1 A01A

Laminated wood spars may be substituted for solid rectangular wood spars

- A — only in certain instances where the primary load is shared by one or more other original structural member.
- B — only upon specific approval by the manufacturer or the FAA.
- C — if the same quality wood is used in both.

Answer C. JSAT 3-2 (AC43.13-1B)
Solid spruce spars may be replaced with laminated ones or vice versa, provided the material is of the same high quality.

3A-2 A01A

The strength of a well designed and properly prepared wood splice joint is provided by the

- A — bearing surface of the wood fibers.
- B — glue.
- C — reinforcement plates.

Answer B. JSAT 3-7 (AC43.13-1B)
When a wood splice is made, the bond between the two pieces of wood consists only of a layer of glue. How strong the joint will be depends on how well the gluing operation was performed.

3A-3 A01A

Where is information found concerning acceptable species substitutions for wood materials used in aircraft repair?

- A — Technical Standard Orders.
- B — Aircraft Specifications or Type Certificate Data Sheets.
- C — AC 43.13-1B.

Answer C. JSAT 3-2 (AC43.13-1B)
The species used to repair a part should be the same as that of the original whenever possible; however, permissible substitutes are given in AC-43.13-1B.

3A-4 A01A

In cases of elongated bolt holes in a wood spar or cracks in the vicinity of bolt holes,

- A — it is permissible to ream the hole, plug with hardwood, and redrill.
- B — a new section of spar should be spliced in or the spar replaced entirely.
- C — the spar may be reinforced by using hardwood reinforcing plates.

Answer B. JSAT 3-11 (AC43.13-1B)
In cases of elongated bolt holes in a spar, or cracks in the vicinity of bolt holes, a new spar section should be spliced in, or the spar should be replaced.

3A-5 A02A

A faint line running across the grain of a wood spar generally indicates

- A — compression failure.
- B — shear failure.
- C — decay.

Answer A. JSAT 3-11 (AC43.13-1B)
Compression failures are characterized by a buckling of the fibers that appear as streaks on the surface of the piece, substantially at right angles to the grain.

3A-6 A02A

Which statement about wood decay is correct?

- A — Decay that occurs before the wood is seasoned does not affect the strength of the finished piece.
- B — A limited amount of certain kinds of decay is acceptable in aircraft woods since decay affects the binding between the fibers and not the fibers themselves.
- C — Decay is not acceptable in any form or amount.

Answer C. JSAT 3-6 (AC43.13-1B)
Decay. All pieces must be free from rot, dote, red heart, purple heart, and all other forms of decay.

3A-7 A02A

Which of the following conditions will determine acceptance of wood with mineral streaks?

- A — Local irregularities do not exceed limitations specified for spiral and diagonal grain.
- B — Careful inspection fails to reveal any decay.
- C — They produce only a small effect on grain direction.

Answer B. JSAT 3-5 (AC43.13-1B)
Mineral streaks are not acceptable in wood if they are accompanied by any decay.

3A-8 A02A

The I beam wooden spar is routed to

- A — reduce weight.
- B — increase strength.
- C — obtain uniform strength.

Answer A. JSAT 3-11 (AC65-15A)
I-beam spars are externally routed on both sides to reduce weight while retaining adequate strength.

3A-9 A02A

Pin knot clusters are permitted in wood aircraft structure provided

- A — no pitch pockets are within 12 inches.
- B — they produce a small effect on grain direction.
- C — they have no mineral streaks.

Answer B. JSAT 3-6 (AC43.13-1B)
Pin knot clusters. Small clusters are acceptable, provided they produce only a small effect on grain direction.

3A-10 A02A

The cantilever wing uses

- A — the skin to carry most of the load to the wing butt.
- B — no external bracing.
- C — external struts or wire bracing.

Answer B. JSAT 1-9 (AC65-15A)
A cantilever wing is one that uses no external bracing.

3A-11 A03A

Laminated wood is sometimes used in the construction of highly stressed aircraft components. This wood can be identified by its

- A — similarity to standard plywood construction.
- B — parallel grain construction.
- C — perpendicular grain construction.

Answer B. JSAT 3-3 (AC65-15A)

Laminated wood is an assembly of two or more layers of wood which have been glued together with the grain of all layers or laminations approximately parallel.

3A-12 A03A

When patching a plywood skin, abrupt changes in cross sectional areas which will develop dangerous stress concentration should be avoided by using

- A — circular or elliptical patches.
- B — square patches.
- C — doublers with any desired shaped patches.

Answer A. JSAT 3-18 (AC65-15A)

Circular and elliptical patches are good to use when repairing plywood skin because they don't have any sharp corners which could set up a stress in the skin.

3A-13 A03A

Glue deterioration in wood aircraft structure is indicated

- A — when a joint has separated and the glue surface shows only the imprint of the wood with no wood fibers clinging to the glue.
- B — by any joint separation.
- C — when a joint has separated and the glue surface shows pieces of wood and/or wood fibers clinging to the glue.

Answer A. JSAT 3-10

To determine whether the glue failed or if the joint was forced apart, examine the surfaces of the damaged joint. If the joint separated and the glue surface showed an imprint of the wood but no wood fibers attached to the glue, the adhesive failed.

3A-14 A03A

Compression failures in wood aircraft structures are characterized by buckling of the fibers that appear as streaks on the surface

- A — at right angles to the growth rings.
- B — at right angles to the grain.
- C — parallel to the grain.

Answer B. JSAT 3-4 (AC43.13-1B)

This defect is caused from the wood being overstressed in compression due to natural forces during the growth of the tree, felling trees on rough or irregular ground, or rough handling of logs or lumber.

3A-15 D02A

When balsa wood is used to replace a damaged honeycomb core, the plug should be cut so that

- A — the grain is perpendicular to the skin.
- B — the grain is parallel to the skin.
- C — it is about 1/8 inch undersize to allow sufficient bonding material to be applied.

Answer A. JSAT 3-61

After damaged honeycomb core has been removed, either a balsa wood or honeycomb replacement plug is installed. If balsa is used, the plug should be cut so the grain is perpendicular to the skin.

3A-16 D05A

What is the purpose of a gusset or gusset plate used in the construction and repair of aircraft structures?

- A — To join and reinforce intersecting structural members.
- B — To provide access for inspection of structural attachments.
- C — To hold structural members in position temporarily until the permanent attachment has been completed.

Answer A. JSAT 3-17, JSAD 156 (AC65-15A)
Gussets are used in the repair of aircraft structures to join and reinforce intersecting structural members. They are used extensively in wood structures.

SECTION B

COMPOSITE STRUCTURES

Section B of Chapter 3 contains information regarding non-metallic structures including advanced composite material nomenclature, fabrication, inspection, and repair techniques.

3B-1 D01A

Metal fasteners used with carbon/graphite composite structures

- A — must be constructed of high strength aluminum-lithium alloy.
- B — must be constructed of material such as titanium or corrosion resistant steel.
- C — may be constructed of any of the metals commonly used in aircraft fasteners.

Answer B. JSAT 3-57

Fasteners used in carbon/graphite must be made of material that is compatible both mechanically and electrically with the carbon/graphite. Aluminum fasteners lack strength and are anodic when in contact with carbon/graphite. Steel fasteners corrode readily when in contact with carbon/graphite. Therefore, suitable fasteners to use in these structures will be made from stainless steel or titanium.

3B-2 D01A

Hole filling fasteners (for example, MS20470 rivets) should not be used in composite structures primarily because of the

- A — possibility of causing delamination.
- B — difficulty in forming a proper shop head.
- C — increased possibility of fretting corrosion in the fastener.

Answer A. JSAT 3-57

If the metal of a solid rivet were expanded to completely fill the hole in a composite structure, the rivet would expand against the sides of the laminate and could cause delamination at the edges of the hole.

3B-3 D02A

Sandwich panels made of metal honeycomb construction are used on modern aircraft because this type of construction

- A — may be repaired by gluing replacement skin to the inner core material with thermoplastic resin.
- B — has a high strength to weight ratio.
- C — is lighter than single sheet skin of the same strength and is more corrosion resistant.

Answer B. JSAT 3-32 (AC65-15A)

Aircraft structure must not only be strong, but rigid as well. Very thin aluminum skins normally provide adequate strength, but lack the rigidity needed. A structural material that provides both the strength and rigidity with light weight is the honeycomb structure.

3B-4 D02A

- (1) When performing a ring (coin tap) test on composite structures, a change in sound may be due to damage or to transition to a different internal structure.
- (2) The extent of separation damage in composite structures is most accurately measured by a ring (coin tap) test.

Regarding the above statements,

- A — only No. 1 is true.
- B — only No. 2 is true.
- C — both No. 1 and No. 2 are true.

Answer A. JSAT 3-40

A change in sound when performing a ring (coin-tap) test may indicate an area of delamination. The change in sound could also be due to the transition to a different internal structure. More sophisticated testing would be necessary to determine the extent of the delamination, if present.

3B-5 D02A

Which of these methods may be used to inspect fiberglass/honeycomb structures for entrapped water?

1. Acoustic emission monitoring.
2. X-ray.
3. Backlighting.

A — 1 and 2.
B — 2 and 3.
C — 1 and 3.

Answer A. JSAT 3-41

Acoustic emission testing detects water, cracks, delamination, and other subsurface flaws. X-ray inspection allows you to “see” moisture trapped in the structure. Backlighting does not detect entrapped water.

3B-6 D02A

One of the best ways to assure that a properly prepared batch of matrix resin has been achieved is to

- A — perform a chemical composition analysis.
B — have mixed enough for a test sample.
C — test the viscosity of the resin immediately after mixing.

Answer B. JSAT 3-35

Mix enough extra resin in each batch to make an identical lay-up on a piece of scrap aluminum. This test sample will give a good indication of the cure time needed, as well as the physical characteristics of the lay-up.

3B-7 D02A

Composite inspections conducted by means of acoustic emission monitoring

- A — pick up the “noise” of corrosion or other deterioration occurring.
B — create sonogram pictures of the areas being inspected.
C — analyze ultrasonic signals transmitted into the parts being inspected.

Answer A. JSAT 3-41

Acoustical emission monitoring is a system using a very sensitive microphone and an amplifier. With it you can pick up the sound of the bubbles associated with active corrosion.

3B-8 D02A

What precaution, if any, should be taken to prevent corrosion inside a repaired metal honeycomb structure?

- A — Prime the repair with a corrosion inhibitor and seal from the atmosphere.
B — Paint the outside area with several coats of exterior paint.
C — None. Honeycomb is usually made from a man made or fibrous material which is not susceptible to corrosion.

Answer A.

When metal is used as a facing for laminated structure, it must be protected from corrosion by using a corrosion-inhibiting primer and a finish that will completely seal the atmosphere away from the repaired area.

3B-9 D02A

One method of inspecting a laminated fiberglass structure that has been subjected to damage is to

- A — strip the damaged area of all paint and shine a strong light through the structure.
B — use an eddy current probe on both sides of the damaged area.
C — use dye penetrant inspection procedures, exposing the entire damaged area to the penetrant solution.

Answer A. JSAT 3-39

If there is surface indication of damage to a fiberglass honeycomb or fiberglass laminated sheet, remove the paint from both sides of the sheet in the suspect area and hold a strong light so it will shine through.

3B-10 D02A

When inspecting a composite panel using the ring test/tapping method, a dull thud may indicate

- A — separation of the laminates.
- B — an area of too much matrix between fiber layers.
- C — less than full strength curing of the matrix.

Answer A. JSAT 3-40 (AC65-15A)

If honeycomb structure is faced with metal, the way to find delamination is by tapping on the surface with a coin. A good bond will produce a clear ringing sound. A delamination will produce a sound which is dull and lifeless.

3B-11 D02A

How many of the following are benefits of using microballoons when making repairs to laminated honeycomb panels?

1. Greater concentrations of resin in edges and corners.
2. Improved strength to weight ratio.
3. Less density.
4. Lower stress concentrations.

- A — 2, 3, and 4.
- B — 1, 2, and 4.
- C — 1, 3, and 4.

Answer A. JSAT 3-30 (AC43.13-1B)

Phenolic microballoons are added to lower the density and give greater flexibility, thus lowering stress concentrations in the repair area. Although microballoons reduce the overall strength, they improved the strength to weight ratio.

3B-12 D03A

The length of time that a catalyzed resin will remain in a workable state is called the

- A — pot life.
- B — service life.
- C — shelf life.

Answer A. JSAT 3-27

The pot life of a catalyzed resin is the amount of time that the mixed resins will be workable. Some resin systems have a very short (45 minutes) pot life, others have a long pot life (4 hours).

3B-13 D03A

A category of plastic material that is capable of softening or flowing when reheated is described as a

- A — thermoset.
- B — thermoplastic.
- C — thermocure.

Answer B. JSAT 3-27

A thermoplastic material is hard in its original state, but will soften and become pliable when it is heated. It can be molded or shaped and will retain its shape when it cools.

3B-14 D03A

The classification for high tensile strength fiberglass used in aircraft structures is

- A — S.
- B — G.
- C — E.

Answer A. JSAT 3-22

S-glass is a magnesia-alumina-silicate glass. It is used where a very high tensile strength fiberglass is needed.

3B-15 D03A

Superficial scars, scratches, surface abrasion, or rain erosion on fiberglass laminates can generally be repaired by applying

- A — a piece of resin impregnated glass fabric facing.
- B — one or more coats of suitable resin (room temperature catalyzed) to the surface.
- C — a sheet of polyethylene over the abraded surface and one or more coats of resin cured with infrared heat lamps.

Answer B. JSAT 3-59 (AC43.13-1B)

Superficial scars, scratches, surface abrasion, or rain erosion can generally be repaired by applying one or more coats of a suitable resin, catalyzed to cure at room temperature.

3B-16 D03A

The classification for fiberglass reinforcement material that has high resistivity and is the most common is

- A — E.
- B — G.
- C — S.

Answer A. JSAT 3-22

E-glass is a borosilicate glass, which is the most common type of fiberglass used for reinforcement. E-glass is known as electric glass because of its high resistivity.

3B-17 D03A

A potted compound repair on honeycomb can usually be made on damages less than

- A — 2 inches in diameter.
- B — 1 inch in diameter.
- C — 4 inches in diameter.

Answer B. JSAT 3-57 (AC65-15A)

Bonded honeycomb structure damage up to 1 inch diameter can be repaired by a hole filling technique known as the "potted compound repair".

3B-18 D03A

Composite fabric material is considered to be the strongest in what direction?

- A — Fill.
- B — Bias.
- C — Warp.

Answer C. JSAT 3-24

In a woven application, there are typically more threads woven into the warp than the fill direction. This material will be stronger in the warp direction. Warp direction may be indicated by inserting another type of thread at periodic intervals.

3B-19 D03A

What reference tool is used to determine how the fiber is to be oriented for a particular ply of fabric?

- A — Fill clock (or compass).
- B — Bias clock (or compass).
- C — Warp clock (or compass).

Answer C. JSAT 3-52

A warp compass is a tool which can be used to reference the orientation of the warp of the fabric.

3B-20 D03A

The strength and stiffness of a properly constructed composite buildup depends primarily on

- A — the orientation of the plies to the load direction.
- B — the ability of the fibers to transfer stress to the matrix.
- C — a 60 percent matrix to 40 percent fiber ratio.

Answer A. JSAT 3-52

Structural composite parts are engineered and manufactured to endure specific stress loads. Their ability to endure these stress loads is dependent, in great measure, to the way in which the fibers are oriented. The fiber orientation of patches must be the same as in the original structure.

3B-21 D03A

Which fiber to resin (percent) ratio for advanced composite wet lay-ups is generally considered the best for strength?

- A — 60:40.
- B — 40:60.
- C — 50:50.

Answer A. JSAT 3-35

A fabric/resin mixture should be about 60/40. A resin rich repair is more susceptible to cracking due to a lack of adequate fiber for support. A resin starved repair is weak in those areas where sufficient resin does not provide stiffness, or because fibers are not held together.

3B-22 D03A

What is the material layer used within the vacuum bag pressure system to absorb excess resin during curing called?

- A — Release.
- B — Bleeder.
- C — Breather.

Answer B. JSAT 3-56

Bleeders are absorbent materials which are used to soak up the excess resins. Always use bleeders in conjunction with a release fabric, peel ply or release film.

3B-23 D03A

Proper pre-preg composite lay-up curing is generally accomplished by

1. applying external heat.
2. room temperature exposure.
3. adding a catalyst or curing agent to the resin.
4. applying pressure.

- A — 1 and 4.
- B — 2 and 3.
- C — 1, 3, and 4.

Answer A. JSAT 3-37, JSAT 3-52 — 3-55
Pre-impregnated (Pre-preg) materials simplify work with composites. In general, most composite manufacturers augment the strength of the finished product by applying heat and pressure to the matrix/fiber mix as it cures.

3B-24 D03A

When repairing large, flat surfaces with polyester resins, warping of the surface is likely to occur. One method of reducing the amount of warpage is to

- A — use less catalyst than normal so the repair will be more flexible.
- B — add an extra amount of catalyst to the resin.
- C — use short strips of fiberglass in the bonded repair.

Answer C. JSAT 3-27

When hinges are installed on top of a large flat surface, using long strips of glass fiber and resin, the shrinkage will often warp the surface out of shape. One way to handle this kind of situation is to use short strips of fiberglass to bond the fasteners to the panel.

3B-25 D03A

When making repairs to fiberglass, cleaning of the area to be repaired is essential for a good bond. The final cleaning should be made using

- A — MEK (methyl ethyl ketone).
- B — a thixotropic agent.
- C — soap, water, and a scrub brush.

Answer A. JSAT 3-47, JSAT 3-50
The surface to be repaired should first be cleaned with soap and water, then scrubbed with methyl-ethyl-ketone. The next step is to sand the area and, finally, it is cleaned again with methyl-ethyl-ketone to remove any sanding residue and moisture.

3B-26 D03A

When necessary, what type of cutting fluid is usually acceptable for machining composite laminates?

- A — Water only.
- B — Water displacing oil.
- C — Water soluble oil.

Answer A. JSAT 3-42

Generally coolant or cutting fluid is not used with composites, for a variety of reasons. Many of these materials will absorb liquids. If water is used, the area should be thoroughly dried before bonding.

3B-27 D03A

Fiberglass laminate damage not exceeding the first layer or ply can be repaired by

- A — sanding the damaged area until aerodynamic smoothness is obtained.
- B — trimming the rough edges and sealing with paint.
- C — filling with a putty consisting of a compatible resin and clean, short glass fibers.

Answer C. JSAT 3-59 (AC43.13-1B)

Damage, not exceeding the first layer or ply of fiberglass laminate, can be repaired by filling with a putty consisting of a compatible resin and filler.

3B-28 D03A

Fiberglass damage that extends completely through a laminated sandwich structure

- A — must be filled with resin to eliminate dangerous stress concentrations.
- B — may be repaired.
- C — may be filled with putty which is compatible with resin.

Answer B. JSAT 3-60 (AC43.13-1B)

Damage that is completely through a laminate sandwich structure may be repaired by such methods as scarfed joint, stepped joint, etc.

3B-29 D03A

Fiberglass laminate damage that extends completely through one facing and into the core

- A — requires the replacement of the damaged core and facing.
- B — can be repaired by using a typical metal facing patch.
- C — cannot be repaired.

Answer A. JSAT 3-61 (AC43.13-1B)

Damage that extends completely through one face of a laminate structure and into the core requires the replacement of the damaged core and facing.

3B-30 D03A

Repairing advanced composites using materials and techniques traditionally used for fiberglass repairs is likely to result in

- A — an unairworthy repair.
- B — improved wear resistance to the structure.
- C — restored strength and flexibility.

Answer A. JSAT 3-45

The older type of fiberglass repairs cannot be used on advanced composite structures. Old style fiberglass repair methods were not necessarily intended to be used to restore full structural strength.

3B-31 D03A

The preferred way to make permanent repairs on composites is by

- A — bonding on metal or cured composite patches.
- B — riveting on metal or cured composite patches.
- C — laminating on new repair plies.

Answer C. JSAT 3-46

When the proper facilities, curing, and bagging equipment are not available, a pre-cured patch inserted with blind fasteners may be used. This type of repair may be considered temporary until the damage can be scarfed down and patches correctly laminated on with heat or pressure.

3B-32 D03A

Which of the following, when added to wet resins, provide strength for the repair of damaged fastener holes in composite panels?

1. Microballoons.
2. Flox.
3. Chopped fibers.

A — 1 and 3.
B — 1, 2, and 3.
C — 2 and 3.

Answer C. JSAT 3-30

Fillers are materials which are added to resins to control viscosity and weight, to increase pot life, and to make application of the resin easier. Flox or chopped fiber may be used for hole reinforcement since they also add strength.

3B-33 D03A

The part of a replacement honeycomb core that must line up with the adjacent original is the

- A — cell edge.
B — cell side.
C — ribbon direction.

Answer C. JSAT 3-31

It is important, when doing a repair, to line up the ribbon direction of the replacement honeycomb core with the ribbon direction of the original part.

3B-34 D03A

Which of the following are generally characteristic of aramid fiber (Kevlar) composites?

1. High tensile strength.
2. Flexibility.
3. Stiffness.
4. Corrosive effect in contact with aluminum.
5. Ability to conduct electricity.

A — 1, 3, and 5.
B — 1 and 2.
C — 2, 3 and 4.

Answer B. JSAT 3-23

Aramid is the name given to aromatic polyimide fibers. They are usually characterized by their yellow color, light weight, excellent tensile strength and remarkable flexibility.

3B-35 D03A

Which of the following are generally characteristic of carbon/graphite fiber composites?

1. Flexibility.
2. Stiffness.
3. High compressive strength.
4. Corrosive effect in contact with aluminum.
5. Ability to conduct electricity.

A — 1, 3, and 5.
B — 2, 3, and 4.
C — 1 and 3.

Answer B. JSAT 3-23

Carbon/graphite fiber is very strong, stiff and has a higher compressive strength than Kevlar. Special corrosion control techniques must be employed when carbon/graphite materials are in contact with aluminum.

SECTION C

TRANSPARENT PLASTIC MATERIALS

Section C of Chapter 3 includes information regarding the installation, inspection, and repair of plastic materials used in aircraft construction.

3C-1 D03A

Which is an identifying characteristic of acrylic plastics?

- A — Zinc chloride will have no effect.
- B — Acrylic has a yellowish tint when viewed from the edge.
- C — Acetone will soften plastic, but will not change its color.

Answer A. JSAT 3-63 (AC65-15A)
Zinc Chloride has no effect on acrylic plastics. Acrylic is incorrect, since yellowing is associated with acetate. Acetone is incorrect, since this is a description of the reaction of acetate to acetone.

3C-2 D04A

If an aircraft's transparent plastic enclosures exhibit fine cracks which may extend in a network over or under the surface or through the plastic, the plastic is said to be

- A — brinelling.
- B — hazing.
- C — crazing.

Answer C. JSAT 3-68 (AC65-15A)
Crazing of plastic enclosures appears as a network of cracks running in all directions over the surface of the plastic. It can also occur within the plastic, at or near cemented joints.

3C-3 D04A

When installing transparent plastic enclosures which are retained by bolts extending through the plastic material and self-locking nuts, the nuts should be

- A — tightened to a firm fit, then backed off one full turn.
- B — tightened to a firm fit, plus one full turn.
- C — tightened to a firm fit.

Answer A. JSAT 3-68 (AC43.13-1B)
Screws or bolts that go through the windshield should be tightened down snug and then backed out a full turn, so the plastic can shift as it expands and contracts.

3C-4 D04A

Which is considered good practice concerning the installation of acrylic plastics?

- A — When rivets are used, adequate spacer or other satisfactory means to prevent excessive tightening of the frame to the plastic should be provided.
- B — When rivets or nuts and bolts are used, slot-
ted holes are not recommended.
- C — When nuts and bolts are used, the plastic should be installed hot and tightened to a firm fit before the plastic cools.

Answer A. JSAT 3-68 (AC43.13-1B)
When rivets are used in the installation of windshields, the installer should provide adequate spacers, or other satisfactory means, to prevent excessive tightening of the frames to the plastic.

3C-5 D04A

The coefficient of expansion of most plastic enclosure materials is

- A — greater than steel but less than aluminum.
- B — greater than both steel and aluminum.
- C — less than either steel or aluminum.

Answer B. JSAT 3-68 (AC43.13-1B)
Plastics expand and contract considerably more than the metal channels in which they are mounted. To accommodate this, windshields are mounted to a sufficient depth in the channel to prevent them from falling out when the panel contracts at low temperatures, or deforms under load.

3C-6 D04A

If no scratches are visible after transparent plastic enclosure materials have been cleaned, their surfaces should be

- A — covered with a thin coat of wax.
- B — buffed with a clean, soft, dry cloth.
- C — polished with rubbing compound applied with a damp cloth.

Answer A. JSAT 3-68 (AC65-15A)
After a windshield is cleaned, a thin coating of wax should be applied to fill any minute scratches that may be present.

3C-7 D04A

What is the most common method of cementing transparent plastics?

- A — Bevel method.
- B — Soak method.
- C — Heat method.

Answer B. JSAT 3-66 (AC65-9A)
There are two methods for cementing plastics — soaking and gluing. The most common method used is soaking method.

3C-8 D04A

When holes are drilled completely through Plexiglas, a

- A — wood drill should be used.
- B — standard twist drill should be used.
- C — specially modified twist drill should be used.

Answer C. JSAT 3-65 (AC65-15A)
When drilling plastic, the drill bit used should be carefully ground, and be free from nicks and burrs, which would affect the surface finish. The drill bit should be ground with a greater included angle than would be used for drilling soft metal.

AIRCRAFT WELDING

SECTION A WELDING PROCESSES

This section of Chapter 4 contains information regarding gas and electric arc welding processes, soldering, and basic structural welding nomenclature.

4A-1 E01A

In Gas Tungsten Arc (GTA) welding, a stream of inert gas is used to

- A — concentrate the heat of the arc and prevent its dissipation.
- B — prevent the formation of oxides in the puddle.
- C — lower the temperature required to properly fuse the metal

Answer B. JSAT 4-4

A stream of inert gas such as argon or helium flows out of the torch and envelopes the arc to exclude oxygen from the area and prevent the formation of oxides.

4A-2 E02A

The oxyacetylene flame for silver soldering should be

- A — carburizing.
- B — oxidizing.
- C — neutral.

Answer C. JSAT 4-12 (AC43.13-1B AC65-15A)
The oxyacetylene flame for silver soldering should be neutral, but may have a slight excess of acetylene. It must be soft, not harsh.

4A-3 E02A

Why is it necessary to use flux in all silver soldering operations?

- A — To chemically clean the base metal of oxide film.
- B — To prevent overheating of the base metal.
- C — To increase heat conductivity.

Answer A. JSAT 4-12 (AC65-15A)

It is necessary to use flux in all silver soldering operations because of the necessity for having the base metal chemically clean without the slightest film of oxide to prevent the silver solder from coming into intimate contact with the base metal.

4A-4 E04A

Which statement concerning soldering is correct?

- A — Joints in electric wire to be soldered should be mechanically secure prior to soldering.
- B — Changeable shades of blue can be observed on the surface of a copper soldering tip when the proper temperature for soldering has been reached.
- C — If the soldering temperature is too high, the solder will form in lumps and not produce a positive bond.

Answer A. JSAT 4-13 (AC65-15A)

Joints must be mechanically secure before soldering. If a soldered joint is subject to vibration, it can fail.

4A-5 E04A

A resurfaced soldering iron cannot be used effectively until after the working face has been

- A — tinned.
- B — fluxed.
- C — polished.

Answer A. JSAT 4-13 (AC65-15A)
Without being tinned, heat cannot readily transfer from the iron to the work.

4A-6 E04A

Which of the following can normally be welded without adversely affecting strength?

1. Aircraft bolts.
2. SAE 4130 chrome/molybdenum tubing.
3. Spring steel struts.
4. Most heat-treated steel/nickel alloy components.

- A — 2.
- B — 2 and 4.
- C — 1 and 3.

Answer A. (AC43.13-1B)
You must be very careful about using welding as a repair procedure. Generally materials, or weldments, which have been heat treated after fabrication are not candidates for field welded repairs. 4130 steel tubing is commonly used both during fabrication and repair.

4A-7 E04A

A very thin and pointed tip on a soldering copper is undesirable because it will

- A — transfer too much heat to the work.
- B — have a tendency to overheat and become brittle.
- C — cool too rapidly.

Answer C. (AC65-15A)
The tip on a soldering copper should be blunt and the entire head should be fairly wide. These features allow the soldering copper to retain its heat for a long enough period of time to perform its intended function.

4A-8 E04A

Filing or grinding a weld bead

- A — may be performed to achieve a smoother surface.
- B — reduces the strength of the joint.
- C — may be necessary to avoid adding excess weight or to achieve uniform material thickness.

Answer B. (AC43.13-1B)
A weld derives part of its strength from the proportions of the bead. Filing or grinding the bead of a weld will reduce its strength.

4A-9 E05A

Which statement concerning a welding process is true?

- A — The inert arc welding process uses an inert gas to protect the weld zone from the atmosphere.
- B — In the oxyacetylene welding process, the filler rod used for steel is covered with a thin coating of flux.
- C — In the metallic arc welding process, filler material, if needed, is provided by a separate metal rod of the proper material held in the arc.

Answer A. JSAT 4-4 (AC65-15A)
In gas-shielded arc welding, a gas is used as a covering shield around the arc to prevent the atmosphere from contaminating the weld.

4A-10 E05A

What purpose does flux serve in welding aluminum?

- A — Removes dirt, grease, and oil.
- B — Minimizes or prevents oxidation.
- C — Ensures proper distribution of the filler rod.

Answer B. JSAT 4-3 (AC65-15A)
Using the proper flux when welding aluminum is extremely important. Aluminum welding flux is designed to remove the aluminum oxide by chemically combining with it.

4A-11 E05A

Oxides form very rapidly when alloys or metals are hot. It is important, therefore, when welding aluminum to use a

- A — filler.
- B — solvent.
- C — flux.

Answer C. JSAT 4-3 (AC65-15A)
Using the proper flux when welding is extremely important. Aluminum welding flux is designed to remove the aluminum oxide by chemically combining with it.

4A-12 E05A

When a butt welded joint is visually inspected for penetration,

- A — look for evidence of excessive heat in the form of a very high bead.
- B — the penetration should be 100 percent of the thickness of the base metal.
- C — the penetration should be 25 to 50 percent of the thickness of the base metal.

Answer B. JSAT 4-6, JSAT 4-9 (AC65-9A)
If it is properly done, the penetration in a butt weld should be 100% of the thickness of the base metal.

4A-13 E05A

Edge notching is generally recommended in butt welding above a certain thickness of aluminum because it

- A — aids in getting full penetration of the metal and prevents local distortion.
- B — helps hold the metal in alignment during welding.
- C — aids in the removal or penetration of oxides on the metal surface.

Answer A. JSAT 4-7 (AC65-15A)
Edge notching is recommended in aluminum welding because it aids in getting full penetration and also prevents local distortion. All butt welds in material over .135 thick are generally notched in some manner to achieve full penetration of the weld.

4A-14 E05A

The shielding gases generally used in the Gas Tungsten Arc (GTA) welding of aluminum consist of

- A — a mixture of nitrogen and carbon dioxide.
- B — helium or argon, or a mixture of helium and argon.
- C — nitrogen or hydrogen, or a mixture of nitrogen and hydrogen.

Answer B. JSAT 4-4
Argon or helium are used to exclude oxygen from the area of the molten metal to prevent oxidation.

SECTION B

ADVANCED WELDING AND REPAIRS

Section B of Chapter 4 includes information on exotic metal welding processes and specific structural repairs using welding processes for repairs.

4B-1 E01A

Which statement best describes magnesium welding?

- A — Filler rod should be nickel steel.
- B — Magnesium can be welded to other metals.
- C — Filler rod should be the same composition as base metal.

Answer C. JSAT 4-16 (AC65-15A)
For the strength of the weld to match the strength of the base metal, the alloy of the filler rod should be of the same composition as the base metal.

4B-2 E01A

Which statement is true in regard to welding heat-treated magnesium?

- A — Magnesium cannot be repaired by fusion welding because of the high probability of igniting the metal.
- B — Flux should not be used because it is very difficult to remove and is likely to cause corrosion.
- C — The welded section does not have the strength of the original metal.

Answer C. (AC43.13-1B AC65-15A)
Repair of magnesium by welding is limited by the fact that if it is used as a structural member, it has probably been heat treated. As is true with heat treated aluminum, welding heat treated magnesium does not leave as much strength as the original metal had.

4B-3 E03A

Engine mount members should preferably be repaired by using a

- A — smaller diameter tube with fishmouth and rosette welds.
- B — larger diameter tube with fishmouth and no rosette welds.
- C — larger diameter tube with fishmouth and rosette welds.

Answer C. (AC43.13-1B AC65-15A)
All welding on an engine mount should be of the highest quality, since vibration tends to accentuate any minor defect. Engine-mount members should preferably be repaired by using a larger diameter replacement tube telescoped over the stub of the original member, using fishmouth and rosette welds.

4B-4 E03A

What method of repair is recommended for a steel tube longeron dented at a cluster?

- A — Welded patch plate.
- B — Welded split sleeve.
- C — Welded outer sleeve.

Answer A. JSAT 4-17 (AC43.13-1B)
A dent at a cluster should be repaired by welding a specially formed steel patch plate over the dented area and surrounding tubes.

4B-5 E04A

Welding over brazed or soldered joints is

- A — not permitted.
- B — permissible for mild steel.
- C — permissible for most metals or alloys that are not heat treated.

Answer A. (AC43.13-1B)

Do not weld brazed or soldered parts as the brazing mixture or solder will penetrate the hot steel and weaken it.

4B-6 E04A

The oxyacetylene flame used for aluminum welding should

- A — be neutral and soft.
- B — contain an excess of acetylene and leave the tip at a relatively low speed.
- C — be slightly oxidizing.

Answer A. JSAT 4-15

The flame use for welding aluminum should be soft and neutral or slightly carburizing, to be sure that there will be no possibility of the metal being oxidized from the welding.

4B-7 E05A

Where should the flux be applied when oxyacetylene welding aluminum?

- A — Applied only to the welding rod.
- B — Painted on the surface to be welded and applied to the welding rod.
- C — Painted only on the surface to be welded.

Answer B. JSAT 4-15 (AC65-15A)

Aluminum welding flux is designed to remove the aluminum oxide by chemically combining with it. The flux can be painted directly on the top and bottom of the joint if no filler rod is required; if filler rod is used, it can be coated.

SECTION C

BASIC GAS WELDING

Section C of Chapter 4 contains information on basic gas welding equipment setup, adjustment, and welding techniques. This section also includes aircraft structural repair processes by gas welding.

4C-1 E04A

In selecting a torch tip size to use in welding, the size of the tip opening determines the

- A — melting point of the filler metal.
- B — temperature of the flame.
- C — amount of heat applied to the work.

Answer C. JSAT 4-26 (AC43.13-1B)

The size of the tip used on an oxyacetylene torch will determine the amount of heat applied to the work. The thickness of the metal will determine which tip size is required.

4C-2 E04A

Why should a carburizing flame be avoided when welding steel?

- A — It hardens the surface.
- B — It removes the carbon content.
- C — A cold weld will result.

Answer A. (AC65-15A)

Care must be taken when welding steel, to ensure that a carburizing (reducing) flame is not used. This flame is one with an insufficient supply of oxygen to ensure complete combustion of the acetylene, and it allows carbon to escape unburned. This carbon will combine with the steel during the welding operation and cause it to become hard and brittle.

4C-3 E04A

The most important consideration(s) when selecting welding rod is

- A — current setting or flame temperature.
- B — material compatibility.
- C — ambient conditions.

Answer B. (AC43.13-1B)

When selecting a welding rod, ensure that it is compatible with the materials to be welded. This ensures that the weld will have the proper mechanical properties such as strength and corrosion resistance for the application.

4C-4 E04A

Acetylene at a line pressure above 15 PSI is

- A — dangerously unstable.
- B — used when a reducing flame is necessary.
- C — usually necessary when welding metal over 3/8 inch thick.

Answer A. JSAT 4-22

Acetylene becomes unstable at pressures of 15 PSI or higher. At 30 PSI it becomes so unstable that the slightest amount of heat generated by the friction of acetylene against the atmosphere will cause it to explode.

4C-5 E04A

Cylinders used to transport and store acetylene

- A — are green in color.
- B — contain acetone.
- C — are pressure tested to 3,000 PSI.

Answer B. JSAT 4-22 (AC65-15A)

Under low pressure at normal temperatures, acetylene is a stable compound. But when compressed in a container to pressures greater than 15 PSI, it becomes dangerously unstable. For this reason, manufacturers fill the acetylene storage cylinders with a porous substance and saturate this substance with acetone. Since acetone is capable of absorbing approximately 25 times its own volume of acetylene gas, a cylinder containing the correct amount of acetone can be pressurized to 250 PSI.

4C-6 E04A

A welding torch backfire may be caused by

- A — using too much acetylene.
- B — a loose tip.
- C — a tip temperature that is too cool.

Answer B. JSAD 38 (AC65-15A)

A backfire may be caused by touching the tip against the work, overheating the tip, a loose tip or head, or dirt or slag in the end of the tip.

4C-7 E05A

Why are aluminum plates 1/4 inch or more thick usually preheated before welding?

- A — Reduces internal stresses and assures more complete penetration.
- B — Reduces welding time.
- C — Prevents corrosion and ensures proper distribution of flux.

Answer A. (AC43.13-1B, AC65-15A)

Preheating of aluminum before welding lessens the strain caused by the large coefficient of expansion of this metal. Preheating also assures a more complete weld penetration, since the high conductivity of aluminum causes heat to be drawn away from the weld.

4C-8 E05A

How should a welding torch flame be adjusted to weld stainless steel?

- A — Neutral.
- B — Slightly oxidizing.
- C — Slightly carburizing.

Answer C. (AC65-15A)

A slightly carburizing flame is recommended for welding stainless steel. The flame should be adjusted so that a feather of excess acetylene, about 1/16" long, forms around the inner cone.

4C-9 E05A

In gas welding, the amount of heat applied to the material being welded is controlled by the

- A — distance the tip is held from the work.
- B — amount of gas pressure used.
- C — size of the tip opening.

Answer C. JSAT 4-26 (AC43.13-1B, AC65-15A)

The nature of the weld, the material, the experience of the welder, and the position in which the weld is to be made, all determine the correct size of the tip opening. The size of the tip opening, in turn, determines the amount of heat applied to the work.

4C-10 E05A

Oxygen and acetylene cylinders are made of

- A — bronze.
- B — seamless aluminum.
- C — steel.

Answer C. JSGT 13-6 (AC65-15A)

Oxygen and acetylene cylinders used in welding operations are made of seamless steel.

4C-11 E05A

If too much acetylene is used in the welding of stainless steel,

- A — oxide will be formed on the base metal close to the weld.
- B — a porous weld will result.
- C — the metal will absorb carbon and lose its resistance to corrosion.

Answer C. (AC65-15A)

When a carburizing flame (an excess of acetylene) is used to weld stainless steel, the metal will absorb carbon and lose its resistance to corrosion.

AIRCRAFT FABRIC COVERING

SECTION A FABRIC COVERING PROCESS

This section contains information regarding basic fabric covering strength requirements and finishing processes.

5A-1 B01A

The determining factor(s) for the selection of the correct weight of textile fabric to be used in covering any type of aircraft is the

- A — speed of the aircraft.
- B — maximum wing loading.
- C — speed of the aircraft and the maximum wing loading.

Answer C. JSAT 5-6 (AC65-15A)
The quality and strength of fabric, surface tape, lacing cord, and thread, etc. are determined by the aircraft's never-exceed speed and the pounds per square foot of wing loading.

5A-2 B01A

Finishing tape (surface tape) is used for what purpose?

- A — To provide additional anti-tear resistance under reinforcement tape.
- B — To help prevent "ripple formation" in covering fabric.
- C — To provide additional wear resistance over the edges of fabric forming structures.

Answer C. JSAT 5-8 (AC43.13-1B)
The purpose of finishing tape is to blend the covering around contours and irregularities. The tape prevents covering material from coming loose in flight.

5A-3 B02A

The strength classification of fabrics used in aircraft covering is based on

- A — bearing strength.
- B — tensile strength.
- C — shear strength.

Answer B. JSAT 5-6
The strength of aircraft fabric is classified by determining its tensile strength, in lb. per inch of width. Do not confuse this with lb. per square inch.

5A-4 B02A

Fabric rejuvenator is used to

- A — restore fabric strength and tautness to at least the minimum acceptable level.
- B — restore the condition of dope coatings.
- C — penetrate the fabric and restore fungicidal resistance.

Answer B. JSAT 5-11
Rejuvenator is a mixture of very potent solvents and plasticizers. It may be used to restore the resilience of doped surfaces.

SECTION B

COVERING PROCEDURES

This section contains information regarding aircraft fabric covering materials and recovering preparations.

5B-1 B01A

When and how is finishing tape applied on a fabric covered aircraft?

- A — Doped on immediately prior to the finish coat.
- B — Doped on after the first or second coat of dope.
- C — Sewed or laced on before dope is applied.

Answer B. JSAT 5-21 (AC43.13-1B)
Finishing tape is used to cover all the lacing, and it must be of at least the same width and quality as that used on the original airplane. It is applied with dope, after the first or second coat of dope has dried.

5B-2 B01A

How many fabric thicknesses will be found in a French fell seam?

- A — Three.
- B — Four.
- C — Five.

Answer B. JSAT 5-17 (AC43.13-1B)
The French-fell seam is illustrated in the above references.

5B-3 B01A

Moisture, mildew, chemicals, and acids have no effect on

- A — glass fabric.
- B — linen fabric.
- C — dacron fabric.

Answer A. (AC65-15A)
Glass cloth is not affected by moisture, mildew, chemicals, or acids.

5B-4 B02A

- (1) Machine sewn seams in aircraft covering fabrics may be of the folded fell or French fell types.
 - (2) A plain lapped seam is never permissible.
- Regarding the above statements,

- A — only No. 2 is true.
- B — only No. 1 is true.
- C — both No. 1 and No. 2 are true.

Answer B. (AC65-15A)
Machine sewn seams should be of the folded fell or French fell types. A plain lapped seam is satisfactory where selvaged edges or pinked edges are joined.

5B-5 B02A

When testing the strength of Grade A cotton fabric covering an aircraft that requires only intermediate grade, the minimum acceptable strength the fabric must have is

- A — 70 percent of its original strength.
- B — 70 percent of the original strength for intermediate fabric.
- C — 56 pounds per inch warp and fill.

Answer B. JSAT 5-12
Fabric is considered airworthy until it deteriorates to a strength of less than 70% of the strength of new fabric. If Grade A Cotton is used on an aircraft that requires only Intermediate Grade fabric, it can deteriorate to 46 lb. (70% of the strength of Intermediate Grade fabric) before it must be replaced.

5B-6 B02A

When dope-proofing the parts of the aircraft structure that come in contact with doped fabric, which of the following provide an acceptable protective coating?

1. Aluminum foil.
2. Resin impregnated cloth tape.
3. Any one-part type metal primer.
4. Cellulose tape.

A — 3 and 4.

B — 1 and 2.

C — 1 and 4

Answer C. JSAT 5-15 (AC65-15A)

Treat all parts of the structure that come into contact with doped fabric with a protective coating, such as aluminum foil, dope-proof paint, or cellulose tape. Clad aluminum and stainless steel parts need not be dope proofed.

SECTION C

INSPECTION AND REPAIR OF FABRIC COVERING

Section C of Chapter 5 contains information regarding specific repair procedures for fabric covered components.

5C-1 B02A

The best method of repair for a fabric covered surface which has an L shaped tear, each leg of which is approximately 14 inches long, is to

- A — sew with a baseball stitch from the center of the tear out toward the extremity of each leg and then dope on a patch.
- B — re-cover the entire bay in which the tear is located.
- C — sew from the end of each leg to the center of the tear with a baseball stitch and then dope on a patch.

Answer A. JSAT 5-26 (AC65-15A)

Tears in fabric should be repaired by sewing the torn edges together using a baseball stitch, and dopping a piece of pinked-edge fabric over the tear. If this damaged area were to exceed 16 inches in any direction, a new panel would need to be sewn and doped in.

AIRCRAFT PAINTING AND FINISHING

SECTION A FABRIC FINISHING PROCESSES

Section A of Chapter 6 contains information regarding finishing processes for fabric covered aircraft including base and top coat finishing techniques.

6A-1 C03A

Fungicidal dopes are used in aircraft finishing as the

- A — final, full-bodied, brushed-on coat to reduce blushing.
- B — first coat to prevent fabric rotting and are applied thin enough to saturate the fabric.
- C — first, full-bodied, brushed-on coat to prevent fungus damage.

Answer B. JSAT 5-10 (AC65-15A)
Fungicidal dope normally is used as the first coat for fabrics to prevent rotting. The first coat is applied extremely thin so it can thoroughly saturate both sides of the fabric.

6A-2 C04A

What is the usual cause of runs and sags in aircraft finishes?

- A — Low atmospheric humidity.
- B — Too much material applied in one coat.
- C — Material is being applied too fast.

Answer B. JSAT 6-4 (AC65-15A)
Sags and runs result from too much paint being applied, causing the film of wet paint to move by gravity, and presenting a sagging appearance.

6A-3 C04A

Which defect in aircraft finishes may be caused by adverse humidity, drafts, or sudden changes in temperature?

- A — Orange peel.
- B — Pinholes.
- C — Blushing.

Answer C. JSAT 6-3
Blushing occurs because of the effects of high humidity and the temperature drop during the evaporation of the solvents in the dope. Anything which affects either the humidity or the speed of solvent evaporation could cause blushing.

SECTION B

AIRCRAFT PAINTING PROCESSES

Section B of Chapter 6 contains information related to the preparation and application of paint finishes on metallic and composite structures.

6B-1 C02A

What is used to slow the drying time of some finishes and to prevent blush?

- A — Reducer.
- B — Retarder.
- C — Rejuvenator.

Answer B. JSAT 6-14

Retarder is a special type of thinner having rich solvents. These dry very slowly and prevent the temperature drop at the surface which causes blush.

6B-2 C02A

Which type of coating typically includes phosphoric acid as one of its components at the time of application?

- A — Wash primer.
- B — Epoxy primer.
- C — Zinc chromate primer.

Answer A. JSAT 6-8

As one component of their system, wash primers use phosphoric acid to create a phosphate film on the surface of the aluminum.

6B-3 C02A

Which properly applied finish topcoat is the most durable and chemical resistant?

- A — Synthetic enamel.
- B — Polyurethane.
- C — Acrylic lacquer.

Answer B. JSAT 6-9

Polyurethane provides the most durable and chemically resistant finish. Polyurethane is a two-part chemically cured finish that has a solids content of up to 60%. The high gloss that is characteristic of these finishes is due to the slow-flowing resins used.

6B-4 C02A

Aluminum-pigment in dope is used primarily to

- A — exclude sunlight from the fabric.
- B — aid in sealing out moisture from the fabric.
- C — provide a silver color.

Answer A. JSAT 5-23

Aluminum pigment is mixed with clear dope and applied to fabric surfaces to help combat the deterioration caused by sunlight.

6B-5 C02A

A correct use for acetone is to

- A — thin zinc chromate primer.
- B — thin dope.
- C — remove grease from fabric.

Answer C. JSAT 6-14 (AC65-15A)

Acetone is a fast-evaporating dope solvent that is suitable for removing grease from fabric prior to doping.

6B-6 C03A

Which of the following is a hazard associated with sanding on fabric covered surfaces during the finishing process?

- A — Overheating of the fabric/finish, especially with the use of power tools.
- B — Static electricity buildup.
- C — Embedding of particles in the finish.

Answer B. JSAT 5-22

When dry sanding a fabric covered aircraft, be sure to electrically ground the structure. Static electricity from sanding can cause a spark to jump inside the structure and ignite volatile fumes.

6B-7 C03A

What is likely to occur if unhydrated wash primer is applied to unpainted aluminum and then about 30 to 40 minutes later a finish topcoat, when the humidity is low?

- A — A dull finish due to the topcoat “sinking in” to primer that is still too soft.
- B — Corrosion.
- C — A glossy, blush-free finish.

Answer B. JSAT 6-9

One of the most critical aspects of the application of wash primer is the necessity of having sufficient moisture in the air. This moisture is required to properly convert the acid into a phosphate film. This process should take about 30-minutes.

6B-8 C03A

Before applying a protective coating to any unpainted clean aluminum you should,

- A — wipe the surface with avgas or kerosene.
- B — avoid touching the surface with bare hands.
- C — remove any conversion coating film.

Answer B. JSAT 6-7

Moisture, skin oils and other contaminants may be left on a surface when you touch it. To prevent problems with the finishing system you should avoid touching surfaces after the final cleaning or wipe-down with M.E.K.

6B-9 C03A

What is likely to occur if hydrated wash primer is applied to unpainted aluminum and then about 30 to 40 minutes later a finish topcoat, when the humidity is low?

- A — A glossy, blush-free finish.
- B — A dull finish due to the topcoat “sinking in” to primer that is still too soft.
- C — Corrosion.

Answer A. JSAT 6-9

This is the proper method of wash primer usage. One of the most critical aspects of the application of wash primer is the necessity of having sufficient moisture in the air. This moisture is required to properly convert the acid into a phosphate film. This process should take about 30-minutes.

6B-10 C04A

Which statement is true regarding paint system compatibility?

- A — Acrylic nitrocellulose lacquers may be used over old nitrocellulose finishes.
- B — Old type zinc chromate primer may not be used directly for touchup of bare metal surfaces.
- C — Old wash primer coats may be overcoated directly with epoxy finishes.

Answer C. JSAT 6-8 (AC65-15A)

Old wash primer coats may be overcoated directly with epoxy finishes. A new second coat of wash primer must be applied if an acrylic finish is to be applied.

SECTION C

FINISHING EQUIPMENT AND SAFETY

Section C of Chapter 6 contains information on the application of finish details on aircraft, including the installation requirements for registration markings.

6C-1 C01A

If registration numbers are to be applied to an aircraft with a letter height of 12 inches, what is the minimum space required for the registration mark N1683C?

Note: $\frac{2}{3} \times \text{height} = \text{character width}$.

$\frac{1}{6} \times \text{height} = \text{width for 1}$.

$\frac{1}{4} \times \frac{2}{3} \text{ height} = \text{spacing}$.

$\frac{1}{6} \times \text{height} = \text{stroke or line width}$.

A — 48 inches.

B — 52 inches.

C — 57 inches.

Answer B. JSAT 6-26

For 12-inch characters the width will be $\frac{2}{3}$ of 12, which equals 8 inches. The 1 will be 2 inches wide, and the spacing will be $\frac{1}{4}$ of 8 inches, or 2 inches. This will give us $8 + 2 + 2 + 2 + 8 + 2 + 8 + 2 + 8 + 2 + 8$, or 52 inches.

6C-2 C01A

If masking tape is applied to an aircraft such as for trim spraying, and is left on for several days and/or exposed to heat, it is likely that the tape will

A — cure to the finish and be very difficult to remove.

B — not seal out the finishing material if the delay or heating occurs before spraying.

C — be weakened in its ability to adhere to the surface.

Answer A. JSAT 6-26

Masking tape should not be allowed to remain on any longer than necessary. If it is difficult to remove, try to soak the tape free with aliphatic naphtha.

AIRFRAME ELECTRICAL SYSTEMS

SECTION A AIRBORNE SOURCES OF ELECTRICAL POWER

This section contains information regarding generators, alternators, and battery power sources, including operating principles, maintenance, and repairing electrical power system components.

7A-1 Q01A

One purpose of a growler test is to determine the presence of

- A — an out of round commutator.
- B — a broken field lead.
- C — a shorted armature.

Answer C. JSAT 7-16

For testing armatures, a device called a growler is used. This device can be used for shorts, opens, proper grounds, and continuity.

7A-2 Q01A

If a generator is equipped with a vibrator type voltage regulator, the actual time the voltage regulator points remain open

- A — is controlled by the reverse current cutout relay point clearance.
- B — depends on the load carried by the generator.
- C — is increased when the external load is greater than the generator output.

Answer B. JSAT 7-13 (AC65-9A)

The actual time voltage regulator points in a vibrator type voltage regulator remain open is determined by the amount of load being carried by the generator. When the load is great, the voltage drops and the points remain closed longer to allow the voltage to rise. When the load is light, the voltage is high and the points remain closed a very short time.

7A-3 Q01A

What is a cause of generator brush arcing?

- A — Low spring tension.
- B — Carbon dust particles.
- C — Seating brushes with No. 000 sandpaper.

Answer A. JSAT 7-7 (AC65-9A)

Excessive pressure on generator brushes will cause rapid wear, but too little pressure will cause "bouncing" of the brushes which results in arcing and burned and pitted surfaces.

7A-4 Q01A

The method most often used in overcoming the effect of armature reaction is through the use of

- A — drum wound armatures in combination with a negatively connected series field.
- B — interpoles.
- C — shaded poles.

Answer B. JSAT 7-11 (AC65-9A)

An interpole is a pole placed between the main poles of a generator. Interpoles may be used to counteract the effects of armature reaction.

7A-5 Q01A

The only practical method of maintaining a constant voltage output from an aircraft generator under varying conditions of speed and load is to vary the

- A — strength of the magnetic field.
- B — number of conductors in the armature.
- C — speed at which the armature rotates.

Answer A. JSAT 7-12 (AC65-9A)
Efficient operation of electrical equipment in an aircraft depends on a constant voltage supply from the generator. Among the factors which determine the voltage output of a generator, only one, the strength of the magnetic field, can be conveniently controlled.

7A-6 Q01A

The pole pieces or shoes used in a DC generator are a part of the

- A — armature assembly.
- B — field assembly.
- C — brush assembly.

Answer B. JSAT 7-6 (AC65-9A)
In small generators, the frame is made of one piece of iron, while in large generators it is usually made up of two parts bolted together. The frame has high magnetic properties and, together with the pole pieces, forms the major part of the magnetic circuit. The frame and the pole pieces are part of the field assembly.

7A-7 Q01A

How many cycles of AC voltage are produced in a six pole alternator of the revolving field type for each revolution of the rotor?

- A — Six.
- B — Four.
- C — Three.

Answer C. JSAT 7-23 (AC65-9A)
The frequency of the alternator voltage depends upon the speed of rotation of the rotor and the number of poles. When a rotor has rotated through an angle so that two adjacent rotor poles (a north and a south pole) have passed one winding, the voltage induced in that winding will have varied through one complete cycle. Two poles produce one cycle, so six poles will produce three cycles.

7A-8 Q01A

If the reverse current cutout relay contact points fail to open after the generator output has dropped below battery potential, current will flow through the generator armature

- A — opposite the normal direction and through the shunt field in the normal direction.
- B — in the normal direction and through the shunt field opposite the normal direction.
- C — and the shunt field opposite the normal direction.

Answer A. JSAT 7-13 (AC65-9A)
The reverse-current cutout is the relay in the voltage regulator which disconnects the battery from the generator. If the battery is not disconnected, it will discharge through the generator armature when the generator voltage falls below that of the battery, thus driving the generator as a motor. When this happens, the current flows opposite the normal direction through the generator armature and in the normal direction through the shunt field.

7A-9 Q01A

In a generator, what eliminates any possible sparking to the brush guides caused by the movement of the brushes within the holder?

- A — Brush spring tension.
- B — The brush pigtail.
- C — Undercutting the mica on the commutator.

Answer B. JSAT 7-7 (AC65-9A)
The purpose of the pigtail on the generator's brushes is to conduct current, rather than subjecting the brush spring to currents which would alter its spring action by overheating. The pigtails also eliminate any possible sparking to the brush guides caused by the movement of the brushes within the holder, thus minimizing side wear of the brush.

7A-10 Q01A

The commutator of a generator

- A — changes direct current produced in the armature into alternating current as it is taken from the armature.
- B — changes alternating current produced in the armature into direct current as it is taken from the armature.
- C — reverses the current in the field coils at the proper time in order to produce direct current.

Answer B. JSAT 7-4

As the generator rotates, an alternating current is generated within the coils and is converted into DC as it is picked up by the brushes riding on the copper segments of the commutator.

7A-11 Q01A

Which of the following is not one of the purposes of interpoles in a generator?

- A — Reduce arcing at the brushes.
- B — Reduce field strength.
- C — Overcome armature reaction.

Answer B. JSAT 7-10 (AC65-9A)

Interpoles in a generator are used to help reduce the effect of armature reaction. They do this by counteracting the field distortion caused by the electromagnetic fields in the windings. Interpoles also improve the efficiency, output, and service life of the brushes. By counteracting field distortion, interpoles effectively increase the field strength.

7A-12 Q01A

To test generator or motor armature windings for opens,

- A — check adjacent segments on commutator with an ohmmeter on the high resistance scale.
- B — use a 12/24V test light between the armature core segments and the shaft.
- C — place armature in a growler and connect a 110V test light on adjacent segments; light should light.

Answer C. JSAT 7-16

When an armature is placed in a growler and the unit is turned on, a potential for current flow exists between segments of the commutator and the armature. A test lamp is connected between a segment of the commutator and the armature and will light if no "open" exists.

7A-13 Q01A

To what depth is the mica insulation between the commutator bars of a DC generator undercut?

- A — Equal to twice the width of the mica.
- B — Equal to the width of the mica.
- C — One half the width of the mica.

Answer B. JSAT 7-17 (AC65-9A)

After a commutator under repair has been turned on a lathe, it is necessary to undercut the mica insulation between the segments to a depth of approximately the width of the mica.

7A-14 Q01A

A voltage regulator controls generator output by

- A — introducing a resistance in generator-to-battery lead in the event of overload.
- B — shorting out field coil in the event of overload.
- C — varying current flow to generator field coil.

Answer C. JSAT 7-12 (AC65-9A)

Among the factors which determine the voltage output of a generator, only one, the strength of the field current, can be conveniently controlled.

7A-15 Q01A

Which type of DC generator is not used as an airplane generator?

- A — Compound wound.
- B — Externally grounded.
- C — Series wound.

Answer C. JSAT 7-8 (AC65-9A)

Series wound generators have very poor voltage regulation qualities, so they are never used as an aircraft generator. In this type of generator, as the load goes up, the voltage goes up. A series wound generator is what would be used with an arc welder.

7A-16 Q01A

What is the most accurate type of frequency measuring instrument?

- A — Electrodynamometers using electromagnetic fields.
- B — Integrated circuit chip having a clock circuit.
- C — Electromagnets using one permanent magnet.

Answer B. JSGT 3-99

For precise frequency measurement, integrated circuit chips having clock circuits are used to actually count the cycles in a given time period and display the frequency as a digital display.

7A-17 Q01A

What does a rectifier do?

- A — Changes direct current into alternating current.
- B — Reduces voltage.
- C — Changes alternating current into direct current.

Answer C. JSAT 7-20 (AC65-9A)

A rectifier is a device which transforms alternating current into direct current by limiting or regulating the direction of current flow.

7A-18 Q01A

When a diode is checked for an open circuit or a short circuit, it should be

- A — checked with a milliamp ammeter.
- B — in the circuit.
- C — disconnected from the circuit.

Answer C. JSAT 7-22

A semiconductor diode is an electrical check valve and, as such, it allows electron flow in one direction but not in the other. To check for a shorted or an open diode, disconnect it from the circuit and measure its resistance with an ohmmeter set on the R x 1 scale.

7A-19 Q01A

Which of the following is most likely to cause thermal runaway in a nickel-cadmium battery?

- A — Constant current charging of the battery to more than 100 percent of its capacity.
- B — A high internal resistance condition.
- C — Excessive current draw from the battery

Answer C. JSAT 7-30

Excessive rates of current flow in a nickel-cadmium battery can cause high temperatures. These temperatures can cause a breakdown of the cellophane-like material that separates the plates in the battery cell. This breakdown creates a short circuit, and current flow increases. The increased current flow will generate additional heat, and cause further breakdown of the separator material. This process is known as vicious-cycling or thermal runaway.

7A-20 Q01A

The voltage output of an alternator may be regulated by controlling the

- A — voltage output of the DC exciter.
- B — speed of the alternator.
- C — resistance in the rotor windings.

Answer A. JSAT 7-21 (AC65-9A)

The output voltage of an alternator is best controlled by regulating the voltage output of the DC exciter, which supplies current to the alternator rotor field.

7A-21 Q02A

If the (+) terminal of a voltmeter is connected to the (-) terminal of the source voltage and the (-) terminal of the meter is connected to the (+) terminal of the source voltage, the voltmeter will read

- A — correctly.
- B — low voltage.
- C — backwards.

Answer C. JSGT 3-94 (AC65-9A)

The connection of the voltmeter described in this question is backwards, so the voltmeter will read backwards. This means the needle will peg out below the "zero" value.

7A-22 Q02A

To help minimize radio interference a capacitor will largely eliminate and provide a steady direct current if the capacitor is connected to the generator in

- A — parallel.
- B — series.
- C — series/ parallel.

Answer A. (AC43.13-1B)

The output of a DC generator normally has some AC hash, or noise, caused by brush arcing superimposed on it. The AC can cause radio interference, and it may be removed by connecting a capacitor between the armature and ground, in parallel with the armature windings. The AC passes to ground through the low impedance path provided by the capacitor.

7A-23 Q03A

One advantage of using AC electrical power in aircraft is

- A — that AC electrical motors can be reversed while DC motors cannot.
- B — that the effective voltage is 1.41 times the maximum instantaneous voltage; therefore, less power input is required.
- C — greater ease in stepping the voltage up or down.

Answer C. JSGT 3-45 (AC65-9A)

Alternating current has largely replaced direct current in commercial power systems for a number of reasons. It can be transmitted over long distances more readily and more economically than direct current, and it can be increased or decreased quite easily by the use of transformers.

7A-24 Q03A

If the positive field lead between a generator and a generator control panel breaks and is shorted while the engine is running, a voltmeter connected to generator output would indicate

- A — normal voltage.
- B — residual voltage.
- C — zero voltage.

Answer B. JSAT 7-15

When residual voltage shows up on a test voltmeter, it indicates that the generator is operating but that there is no field current. This means that the field circuit is open because of a broken or loose wire or that the voltage regulator is defective.

7A-25 Q03A

What is a method used for restoring generator field residual magnetism?

- A — Energize the armature.
- B — Flash the fields.
- C — Reseat the brushes.

Answer B. JSAT 7-15 (AC65-9A)

To restore residual magnetism to a generator, the field needs to be flashed by removing the regulator and connecting a jumper from the positive bus to the generator field. This is done while the engine is running at cruise RPM.

7A-26 Q03A

The major advantages of alternating current (AC) over direct current (DC) is the fact that its current and voltage can easily be increased or decreased

- A — by means of an inverter.
- B — by means of a transformer.
- C — by means of a rectifier.

Answer B. JSGT 3-45 (AC65-9A)

Transformers are used to step up or step down the voltage in a system. It is advantageous to transmit AC at a high voltage and then step it down to a lower voltage by using a transformer.

7A-27 Q03A

When using an ohmmeter to check the continuity of a generator field coil, the coil should

- A — show very low resistance if it is a series field coil.
- B — be removed from the generator housing.
- C — show high resistance when the meter leads are connected to the terminals of the coil.

Answer A. JSAT 7-16

To test the field coil of a generator for continuity, the leads of an ohmmeter are connected to the terminals of the coil. The shunt field coil should show low resistance, approximately 2 to 30 ohms. A series field coil should show practically no resistance because it carries the entire load to the generator and the internal resistance of the generator must be as low as possible.

7A-28 Q03A

The strength of the core of an electromagnet depends upon the material from which it is constructed and which of the following?

- A — The size (cross section) and the number of turns of wire in the coil and the applied voltage.
- B — The number of turns of wire in the coil and the applied voltage.
- C — The number of turns of wire in the coil and the amount of current (amperes) passing through the coil.

Answer C. JSGT 3-51 (AC65-9A)

With a fixed core material, the strength of an electromagnet will increase in proportion to the number of turns of wire around the core and the amount of current passing through the wire. As current passes through a wire, a magnetic field is created around the wire. For this reason, the greater the number of turns of wire or the greater the current flow, the stronger the electromagnet.

7A-29 Q03A

A voltage regulator controls generator voltage by changing the

- A — current in the generator output circuit.
- B — resistance of the generator field circuit.
- C — resistance in the generator output circuit.

Answer B. JSAT 7-12 (AC65-9A)

If the current supplied to the field circuit is increased, the voltage output of a generator is increased. By varying the resistance in the field circuit, the voltage regulator controls the current flow and consequently the voltage output.

7A-30 Q03A

The most common method of regulating the voltage output of a compound DC generator is to vary the

- A — current flowing through the shunt field coils.
- B — resistance of the series field circuit.
- C — total effective field strength by changing the reluctance of the magnetic circuit.

Answer A. JSAT 7-12 (AC65-9A)

A compound generator is one that has series field coils and shunt field coils. Regardless of the type of generator, voltage output is always regulated by varying the current flowing through the shunt field coils.

7A-31 Q03A

If any one generator in a 24-volt DC system shows low voltage, the most likely cause is

- A — a defective reverse current cutout relay.
- B — shorted or grounded wiring.
- C — an out of adjustment voltage regulator.

Answer C. JSAT 7-12 (AC65-9A)

A defective reverse current relay would allow battery power to flow in the reverse direction into the generator. Shorted wiring would most likely cause a total cessation of generation. An out of adjustment regulator could result in low voltage.

7A-32 Q03A

Aircraft which operate only AC generators (alternators) as a primary source of electrical power normally provide current suitable for battery charging through the use of

- A — a stepdown transformer and a rectifier.
- B — a dynamotor with a half wave DC output.
- C — an inverter and a voltage dropping resistor.

Answer A. JSAT 7-49 (AC65-9A)

Because batteries produce direct current and therefore need direct current to be charged, aircraft which operate with AC producing alternators generally use a stepdown transformer and a rectifier to produce a suitable direct current for charging the batteries.

7A-33 Q03A

Major adjustments on equipment such as regulators, contactors, and inverters are best accomplished outside the airplane on test benches with necessary instruments and equipment. Adjustment procedure should be as outlined by

- A — the equipment manufacturer.
- B — aircraft technical orders.
- C — the FAA.

Answer A. JSAT 7-18, JSAT 7-76 (AC43.13-1B)

When adjustments are being made to regulators, contacts, and inverters, the adjustment procedures outlined by the equipment manufacturer should be followed.

7A-34 Q03A

In an AC circuit with no phase lead or lag, which is true?

- A — Real power is greater than apparent power.
- B — Real power is zero.
- C — Real power equals apparent power.

Answer C. JSAT 3-50 (AC65-9A)

In an alternating current circuit, the true or real power is seldom equal to the apparent power, because the voltage and the current are not always in phase with each other. If they are in phase, however, the true power will equal the apparent power.

7A-35 Q03A

How are generators rated?

- A — Amperes at rated voltage.
- B — Watts at rated voltage.
- C — The impedance at rated voltage.

Answer A. JSAT 7-12 (AC65-9A)

A generator is rated in power output. Since a generator is designed to operate at a specified voltage, the rating is usually given as the number of amperes the generator can safely supply at its rated voltage.

7A-36 Q03A

How is a shunt wound DC generator connected?

- A — One field is shunted across the other.
- B — The field and armature are shunted with a capacitor.
- C — Both fields are shunted across the armature.

Answer C. JSAT 7-8 (AC65-9A)

In a shunt-wound DC generator the fields are in parallel with (shunted across) the armature.

7A-37 Q03A

The poles of a generator are laminated to

- A — increase flux concentration.
- B — reduce flux losses.
- C — reduce eddy current losses.

Answer C. JSAT 7-6 (AC65-9A)

The field poles of a generator are bolted to the inside of the frame and form a core on which the

field coil windings are mounted. The poles are usually laminated to reduce eddy current losses and serve the same purpose as the iron core of an electromagnet; that is, they concentrate the lines of force produced by the field coils.

7A-38 Q03A

What is the frequency of an alternator dependent upon?

- A — RPM.
- B — Voltage.
- C — Current.

Answer A. JSAT 7-25 (AC65-9A)

The frequency of the alternator voltage depends upon the speed of rotation of the rotor and the number of poles. The faster the speed, the higher the frequency will be; the lower the speed, the lower the frequency becomes. The more poles on the rotor, the higher the frequency will be for a given speed.

7A-39 Q03A

The generator rating is usually found stamped on the

- A — engine.
- B — firewall.
- C — generator.

Answer C. JSAT 7-12 (AC65-9A)

Generator rating and performance data are stamped on the name plate attached to the generator. When replacing a generator, it is important to choose one of the proper rating.

7A-40 Q03A

Residual voltage is a result of magnetism in the

- A — field shoes.
- B — armature.
- C — field windings.

Answer A. JSAT 7-15

The two most likely indications of generator system trouble are (1) no voltage and (2) residual voltage. Residual voltage is the result of residual magnetism in the field poles. When residual voltage shows on the voltmeter, it indicates that the generator is operating but that there is no field current.

7A-41 Q03A

(Refer to Airframe figure 18) Which of the batteries are connected together incorrectly?

- A — 3.
- B — 1.
- C — 2.

Answer A. JSGT 3-24 — 3-29 (AC65-9A)
Storage batteries can be connected either in series to add voltage, or in parallel to increase capacity, but not as combined in drawing 3.

7A-43 Q04A

A CSD unit drives a generator through the use of

- A — a variable hydraulic pump and hydraulic motor.
- B — a synchronous electric motor.
- C — an infinitely variable mechanical gearing system.

Answer A. JSAT 7-25
A CSD consists of a hydraulic motor driven by a hydraulic pump.

7A-42 Q04A

CSD driven generators are usually cooled by

- A — both ram air and an integral fan.
- B — an integral fan.
- C — oil spray.

Answer A. JSAT 7-50
The Constant Speed Drive (CSD) unit has its own lubrication system, and the generator is cooled by ram air and an integral fan.

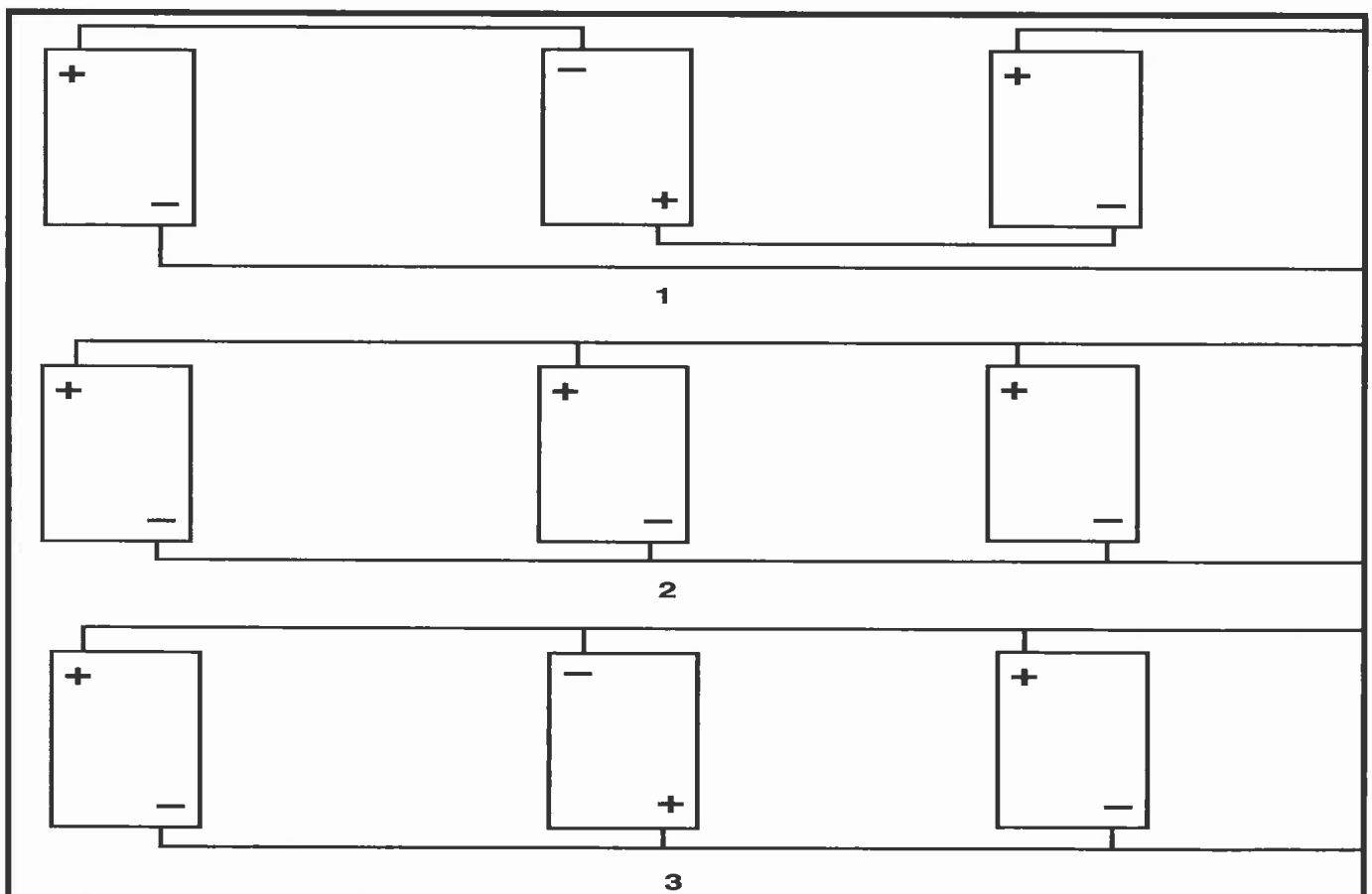


Figure 18. — Battery Connections

7A-44 Q04A

Integrated drive generators (IDG) employ a type of high output AC generator that utilizes

- A — a brushless system to produce current.
- B — brushes and slip rings to carry generated DC exciter current to the rotating field.
- C — battery current to excite the field.

Answer A. JSAT 7-25

An integrated drive generator (IDG) is a high output brushless alternator built into a single unit with a constant speed drive (CSD). A permanent magnet generator produces three phases AC, which is sent to the voltage regulator section of the generator control unit (GCU). The output of the GCU supplies current to the exciter field coil, which controls the output voltage of the generator.

7A-45 Q04A

If the IDG scavenge oil filter is contaminated with chunks or pieces of metal

- A — replace the oil and filter at 25 hour intervals.
- B — change the oil at 25 hour intervals.
- C — remove and replace the IDG.

Answer C. JSAT 7-25

If a problem is found within IDG, it usually is not repairable at the local level, and is simply removed and replaced with a new serviceable unit.

7A-46 Q04A

When necessary during operation, CSD disconnect is usually accomplished by

- A — a shear section in the input shaft.
- B — a switch in the cockpit.
- C — circuit breaker activation.

Answer B. JSAT 7-50, JSTS 4-2

Constant speed drive units are equipped with an electrically actuated disconnect that is controlled manually by a switch in the cockpit or automatically by the generator control unit. The disconnect is actuated if certain types of generator malfunctions occur.

7A-47 Q04A

A CSD unit that is disconnected in flight, due to a malfunction such as overtemperature, may be reconnected

- A — manually by the flightcrew.
- B — automatically if the temperature falls back into the normal operating range.
- C — only on the ground by maintenance personnel.

Answer C. JSAT 7-25, JSTS 4-2

CSD units can be disconnected in flight, in the event of a malfunction, but they can be connected only on the ground.

SECTION B

AIRCRAFT ELECTRICAL CIRCUITS

Section B of Chapter 7 includes information on electrical circuit components and analyzing electrical circuit functions. Electrical power distribution circuits are also included in this section.

7B-1 Q01A

When AC generators are operated in parallel, the

- A — amperes and voltage must both be equal.
- B — amperes and frequency must both be equal.
- C — frequency and voltage must both be equal.

Answer C. JSAT 7-50 (AC65-9A)

Synchronizing, or paralleling, of AC generators (alternators) is somewhat similar to paralleling DC generators, except that there are more steps with the generators. In order to synchronize (parallel) two or more AC generators to the same bus, they must have the same phase sequence as well as equal voltages and frequencies.

7B-2 Q01A

An ammeter in a battery charging system is for the purpose of indicating the

- A — rate of current used to charge the battery.
- B — amperage available for use.
- C — total amperes being used in the airplane.

Answer A. JSAT 7-36 (AC65-9A)

The function of an ammeter is to indicate current flow. In a battery charging circuit, the ammeter shows the amount of current being used to charge the battery.

7B-3 Q01A

During ground operation, aircraft generator cooling is usually accomplished by

- A — auxiliary air cooled through an air/fuel heat exchanger.
- B — an integral fan.
- C — an external motor-driven fan.

Answer B.

Cooling air for generators may be supplied, on the ground, by a fan mounted on the generator shaft or by bleed air from the turbine engine compressor.

7B-4 Q01A

What type of instrument is used for measuring very high values of resistance?

- A — Shunt type ohmmeter.
- B — Multimeter.
- C — Megohmmeter.

Answer C. JSGT 3-92 (AC65-9A)

The megger, or megohmmeter, is a high-range ohmmeter containing a hand-operated generator. It is used to measure insulation resistance and other high resistance values.

7B-5 Q02A

Grounding is electrically connecting a conductive object to the primary structure. One purpose of grounding is to

- A — prevent development of radio frequency potentials.
- B — prevent current return paths.
- C — allow static charge accumulation.

Answer A. JSAT 7-35 (AC65-15A)

Grounding is the electrical connecting of a conducting object to the primary structure for a return path for current. One of the reasons for grounding is to prevent the development of radio frequency potentials.

7B-6 Q02A

When using the voltage drop method of checking circuit resistance, the

- A — input voltage must be maintained at a constant value.
- B — output voltage must be maintained at a constant value.
- C — input voltage must be varied.

Answer A. JSAT 3-24 — 3-28 (AC65-9A)
One method of determining the resistance in a series circuit is to determine the voltage drop at each of the resistors. Because current is constant in the circuit, if the voltage drop at each resistor is known, the resistance can be calculated by using Ohm's Law.

7B-7 Q02A

The primary considerations when selecting electric cable size are

- A — the voltage and amperage of the load it must carry.
- B — the system voltage and cable length.
- C — current carrying capacity and allowable voltage drop.

Answer C. JSAT 7-54 (AC65-15A)
When selecting the size of electric cable to use for a job, the things to consider are the allowable power loss in the line, the permissible voltage drop in the line, and the current carrying ability of the conductor.

7B-8 Q02A

In installations where the ammeter is in the generator or alternator lead, and the regulator system does not limit the maximum current that the generator or alternator can deliver, the ammeter can be redlined at what percent of the generator or alternator rating?

- A — 75.
- B — 100.
- C — 50.

Answer B. JSAT 7-36 (AC43.13-1B)
In installations where the ammeter is in the generator or alternator lead, and the regulator system does not limit the maximum current that the generator or alternator can deliver, the ammeter can be redlined at 100 percent of the generator or alternator rating. If the ammeter reading is never allowed to exceed the red line, except for short intermittent loads, the generator or alternator will not be overloaded.

7B-9 Q02A

How should a voltmeter be connected?

- A — In series with the load.
- B — In parallel with the load.
- C — In series with the source.

Answer B. JSAT 3-90 (AC65-9A)
Voltage measuring instruments are always connected across (in parallel with) the circuit. Care should be taken to ensure that the positive terminal of the voltmeter is connected to the positive terminal of the source. If the meter is hooked up backwards, the needle will be driven below zero.

7B-10 Q03A

Certain transport aircraft use AC electrical power for all normal operation and battery furnished DC electrical power for standby emergency use. In aircraft of this type that operate no DC generators, the batteries are kept charged by

- A — rectifiers which use the aircraft's AC generators as a source of power.
- B — alternators which use the aircraft's generators as a source of power.
- C — inverters which use the aircraft's AC generators as a source of power.

Answer A. JSAT 7-49 (AC65-9A)

Aircraft which have AC electrical systems, and utilize an AC producing alternator, still have batteries which put out direct current. The batteries on these aircraft are kept charged by rectifying the AC coming off the alternator, which converts it to direct current. The device that does this is called a rectifier.

7B-11 Q03A

Which of the following must be accomplished when installing an anticollision light?

- A — Install a switch independent of the position light switch.
- B — Connect the anticollision light to the aircraft position light switch.
- C — Use shielded electrical cable to assure fail safe operation.

Answer A. (AC43.13-2A)

According to AC43.13-2A, when an anticollision light is installed, a switch needs to be used which is independent of the position light system switch.

7B-12 Q03A

The inductor type inverter output voltage is controlled by the

- A — dc stator field current.
- B — voltage regulator.
- C — number of poles and the speed of the motor.

Answer A. JSAT 7-44 (AC65-9A)

Inductor-type rotary inverters control their output voltage by controlling the current supplied to the DC stator field.

7B-13 Q03A

The overvoltage control automatically protects the generator system when excessive voltage is present by

- A — opening and resetting the field control relay.
- B — breaking a circuit to the trip coil of the field control relay.
- C — opening the shunt field circuit.

Answer C. JSAT 7-38 (AC65-9A)

An overvoltage relay in the field circuit senses the output voltage and if excessive, opens the field circuit shutting off the generator output.

7B-14 Q03A

When DC generators are operated in parallel to supply power for a single load, their controls include an equalizer circuit to assure that all generators share the load equally. The equalizer circuit operates by

- A — decreasing the output of the high generator to equal the output of the low generator.
- B — increasing the output of the low generator and decreasing the output of the high generator until they are equal.
- C — increasing the output of the low generator to equal the output of the high generator.

Answer B. JSAT 7-45 (AC65-9A)

The generator equalizing system depends on the voltage drop in some calibrated resistors to determine what it will do. If all the generators are supplying the same current, the voltage drop in all the ground leads will be the same. If the current supplied by the generators is unequal, there will be a greater voltage drop in the ground lead of the generator which is supplying more current. The equalizing system senses this and acts to aid the voltage coil in the regulator of the weak generator and oppose the voltage coil in the regulator of the strong generator. This causes the output of the weak generator to increase and the output of the strong generator to decrease.

7B-15 Q03A

A battery generator system provides direct current. On installations requiring alternating current from the battery generator system, it is necessary to have

- A — a variable resistor between the battery and generator.
- B — a transformer.
- C — an inverter.

Answer C. JSAT 7-44 (AC65-9A)

An inverter is a device which converts a portion of the aircraft's direct current to alternating current. This AC is used mainly for instruments, radio, radar, and lighting.

7B-16 Q03A

The purpose of a rectifier in an electrical system is to change

- A — direct current to alternating current.
- B — alternating current to direct current.
- C — the frequency of alternating current.

Answer B. JSAT 7-20 (AC65-9A)

The purpose of a rectifier is to change alternating current to direct current.

7B-17 Q03A

In troubleshooting an electrical circuit, if an ohmmeter is properly connected across a circuit component and some value of resistance is read,

- A — either the component or the circuit is shorted.
- B — the component has continuity and is not open.
- C — the component has continuity and is open.

Answer B. JSGT 3-96 (AC65-9A)

If the component or circuit was shorted, the meter would read zero ohms. If the component had no continuity and is open, the meter would read infinity. Only B. would result in a reading of some measurable amount of ohms.

7B-18 Q03A

(Refer to Airframe figure 19) Upon completion of the landing gear extension cycle, the green light illuminated and the red light remained lit. What is the probable cause?

- A — Short in the up limit switch.
- B — Short in the gear safety switch.
- C — Short in the down limit switch.

Answer A. JSAT 7-40

The red warning light in this circuit gets its power through wire #8, the up limit switch, wire #19, and circuit breaker #5. The only one of these items that could cause the light to be on when it shouldn't be is the up limit switch.

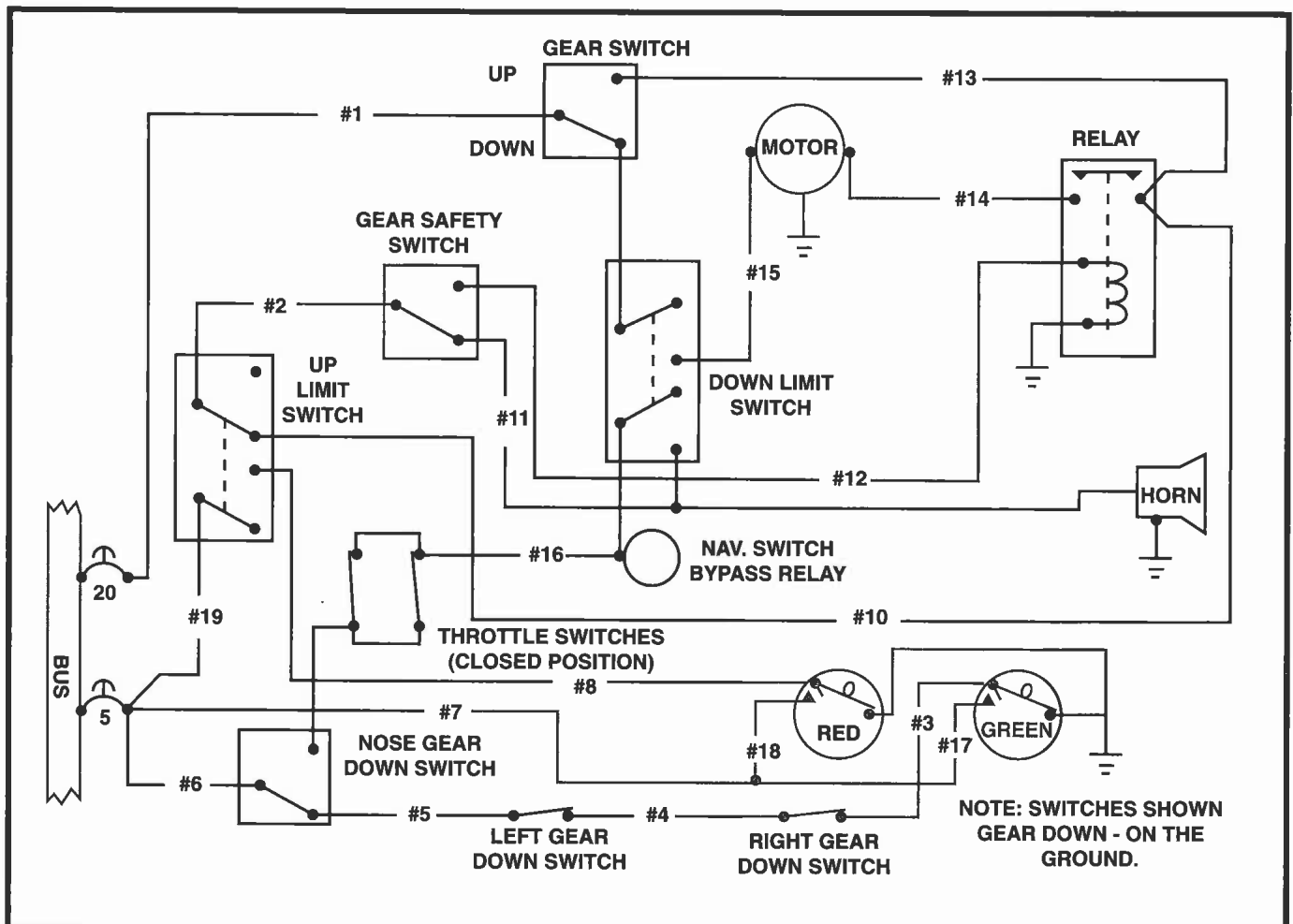


Figure 19. — Landing Gear Circuit

SECTION C

WIRING INSTALLATION

Section C of Chapter 7 contains information regarding wiring selection, installation, and repair; including soldering and crimping of electrical wire terminals.

7C-1 Q01A

Electric wire terminals for most aircraft applications must be what type?

- A — Ring.
- B — Hook.
- C — Slotted.

Answer A. JSAT 7-59

The ring-type terminal is less likely to fail than slide-on type terminals.

7C-2 Q01A

The type of electric wire terminals used for most aircraft applications, in addition to providing good current carrying capabilities, are designed primarily

- A — to prevent circuit failure due to terminal disconnection.
- B — for permanent connection to the circuit.
- C — for uncomplicated and rapid circuit connection and disconnection.

Answer A. JSAT 7-59

Ring-type terminals are used because they are less likely to fail, causing a circuit interruption.

7C-3 Q01A

Aluminum wire must be stripped very carefully because

- A — high resistance will develop in stripping nicks.
- B — stripping nicks can cause short circuits.
- C — individual strands will break easily after being nicked.

Answer C. JSAT 7-60 (AC65-15A)

Aluminum wire must be stripped very carefully, using extreme care, because individual strands will break very easily after being nicked.

7C-4 Q01A

For general electrical use in aircraft, the acceptable method of attaching a terminal to a wire is by

- A — crimping.
- B — soldering.
- C — crimping and soldering

Answer A. JSAT 7-59

A properly installed crimp-on terminal will be at least as strong as the wire itself. Soldering makes a wire more rigid and more likely to break at the terminal.

7C-5 Q01A

Which of the following factors must be taken into consideration when determining the wire size to use for an aircraft installation?

1. Mechanical strength.
2. Allowable power loss.
3. Ease of installation.
4. Resistance of current return path through the aircraft structure.
5. Permissible voltage drop.
6. Current carrying capability of the conductor.
7. Type of load (continuous or intermittent).

A — 1, 2, 4, and 5.

B — 2, 4, 6, and 7.

C — 2, 5, 6, and 7.

Answer C. JSAT 7-54 (AC65-15A)

Several factors must be considered in selecting the size of wire for transmitting and distributing electrical power. They are the allowable power loss, permissible voltage drop in the line, the current-carrying ability of the conductor, and whether or not the load is continuous or intermittent.

7C-6 Q01A

When selecting hardware for attaching bonding connections to an aircraft structure, which of the following should be considered?

1. Mechanical strength.
2. Allowable power loss.
3. Ease of installation.
4. Permissible voltage drop.
5. Amount of current to be carried.
6. Type of load (continuous or intermittent).

- A — 1, 3, and 5.
B — 1, 2, and 3.
C — 4, 5, and 6.

Answer A. JSAT 7-64 (AC65-15A)

Hardware used to make bonding or grounding connections should be selected on the basis of mechanical strength, the current to be carried, and ease of installation.

7C-7 Q01A

How should the splices be arranged if several are to be located in an electrical wire bundle?

- A — Enclosed in a conduit.
B — Grouped together to facilitate inspection.
C — Staggered along the length of the bundle.

Answer C. JSAT 7-63 (AC43.13-1B)
Stagger splices so the bundle doesn't become too large.

7C-8 Q01A

What is the minimum bend radius for an electrical wire bundle?

- A — Ten times the outside diameter of the bundle.
B — Fifteen times the outside diameter of the bundle.
C — Five times the outside diameter of the bundle.

Answer A. JSAT 7-58 (AC43.13-1B)
Avoid a bending radius of less than 10 times the outer diameter of the bundle.

7C-9 Q01A

When approved, splices may be used to repair manufactured harnesses or installed wiring. The maximum number of splices permitted between any two connectors is

- A — three.
B — two.
C — one.

Answer C. (AC43.13-1B)

Splices should be kept to a minimum and avoided entirely in areas subject to extreme vibrations.

7C-10 Q01A

AN/MS electrical connectors are specifically designed to meet

- A — International Civil Aviation Organization (ICAO) standards.
B — Technical Standard Order (TSO) specifications.
C — military specifications.

Answer C. JSAT 7-61

AN (Air Force-Navy) and MS (Military Standards) are both hardware identification systems originating in the military.

7C-11 Q01A

The most common method of attaching a pin or socket to an individual wire in an MS electrical connector is by

- A — crimping and soldering.
B — crimping.
C — soldering.

Answer A. JSAT 7-61

Earlier versions of AN/MS connectors used solder to connect each wire to its pin or socket. Newer connectors used crimp-type terminations.

7C-12 Q01A

The pin section of an AN/MS connector is normally installed on

- A — either side of a circuit (makes no difference).
- B — the ground side of a circuit.
- C — the power supply side of a circuit.

Answer B. JSAT 7-61

To eliminate possible short circuits to ground, the end of the connector that carries the power uses socket connectors.

7C-13 Q02A

If several long lengths of electrical cable are to be installed in rigid conduit, the possibility of damage to the cable as it is pulled through the conduit will be reduced by

- A — applying a light coat of dielectric grease.
- B — dusting the cable with powdered graphite.
- C — dusting the cable with powdered soapstone.

Answer C. JSAT 7-59 (AC65-15A)

Dusting of electrical cable with powdered soapstone prior to routing it through rigid conduit is advisable because the cable will have less tendency to bind or hang up. This will also reduce chafing or abrasion.

7C-14 Q02A

What is normally used to bond noncontinuous stainless steel aircraft components?

- A — Aluminum jumpers.
- B — Stainless steel jumpers.
- C — Copper jumpers.

Answer C. JSAT 7-64 (AC43.13-1B AC65-15A)
Aluminum alloy jumpers are recommended for most bonding connections. Copper jumpers, however, are used to bond together parts made of stainless steel, cadmium-plated steel, copper, brass, or bronze.

7C-15 Q02A

Oil canning of the sides of aluminum or steel electrical junction boxes is considered to be

- A — normal operation in vibration prone areas.
- B — acceptable operation.
- C — a shorting hazard.

Answer C. JSAT 7-63

Junction boxes should be fabricated of such material, and installed in such a manner as to prevent oil-canning. Oil canning is considered a shorting hazard.

7C-16 Q02A

Electric wiring installed in aircraft without special enclosing means (open wiring) offers the advantages of ease of installation, simple maintenance, and reduced weight. When bundling open wiring, the bundles should

- A — be limited as to the number of cables to minimize damage from a single electrical fault.
- B — include at least one shielded cable to provide good bonding of the bundle to the airframe.
- C — be limited to a minimum bend radius of five times the bundle diameter to avoid excessive stresses on the cable insulation.

Answer A. JSAT 7-57 (AC43.13-1B)

When wire is being run in bundles, to simplify maintenance and to minimize the damage that may result from a single fault, the number of wires in the run should be limited.

7C-17 Q02A

During inspection of the terminal strips of an aircraft electrical system, it should be determined that

- A — only plain nuts and lockwashers have been used for terminal attachment to the studs.
- B — only locknuts have been used for terminal attachment to the studs.
- C — the terminal studs are anchored against rotation.

Answer C. JSAT 7-62 (AC65-15A)

Terminal lugs should be installed on terminal blocks so that they are locked against movement in the direction of loosening.

7C-18 Q02A

What protection to wires and cables does conduit provide when used in aircraft installations?

- A — Mechanical.
- B — Structural.
- C — Electromagnetic.

Answer A. JSAT 7-58 (AC65-15A)
Conduit is used in aircraft installations for the mechanical protection of wires and cables.

7C-19 Q02A

Which of the following should be accomplished in the installation of aircraft wiring?

- A — Provide adequate slack in the wire bundle to compensate for large changes in temperature.
- B — Locate the bundle above flammable fluid lines and securely clamp to structure.
- C — Support the bundle to structure and/or solid fluid lines to prevent chafing damage.

Answer B. JSAT 7-58 (AC43.13-1B AC65-15A)
Wiring must be routed at least six inches spacing above flammable-fluid lines whenever possible.

7C-20 Q02A

Aircraft electrical junction boxes located in a fire zone are usually constructed of

- A — stainless steel.
- B — cadmium plated steel.
- C — asbestos.

Answer A. JSAT 7-63 (AC43.13-1B)
When fire-proofing is necessary, a junction box made out of stainless steel is recommended.

7C-21 Q02A

How does the routing of coaxial cables differ from the routing of electrical wiring?

- A — Coaxial cables are routed parallel with stringers or ribs.
- B — Coaxial cables are routed as directly as possible.
- C — Coaxial cables are routed at right angles to stringers or ribs.

Answer B. JSAT 7-64 (AC65-9A)
All wiring should be installed so that it is mechanically and electrically sound and neat in appearance. Most electrical wiring should be routed parallel with, or at right angles to, aircraft structural members like stringers or ribs. An exception to this method of routing is coaxial cable, which is routed as directly as possible.

7C-22 Q02A

Which of the following copper electrical cable sizes should be selected to replace a No. 6 aluminum electrical cable?

- A — No. 6.
- B — No. 8.
- C — No. 4.

Answer B. JSAT 7-53 (AC43.13-1B)
Aluminum wire can be substituted for copper wire if the size of the wire is increased. Two sizes larger should be used when the substitution is made, but aluminum wire smaller than a number 6 should not be used. Remembered that, as the number gets smaller, the wire size gets larger. A number 10 copper wire could be substituted for a number 6 aluminum. No. 8 is the closest answer.

7C-23 Q02A

Which statement relating to electric wiring is true?

- A — When attaching a terminal to the end of an electric cable, it should be determined that the strength of the cable to terminal joint is at least twice the tensile strength of the cable.
- B — All electric cable splices should be covered with soft insulating tubing (spaghetti) for mechanical protection against external abrasion.
- C — When attaching a terminal to the end of an electric cable, it should be determined that the strength of the cable to terminal joint is at least equal to the tensile strength of the cable itself.

Answer C. JSAT 7-60 (AC43.13-1B)

Terminals are attached to the ends of electric wires to facilitate connection of the wires to terminal strips or items of equipment. The tensile strength of the wire to terminal joint should be at least equivalent to the tensile strength of the wire itself, and its resistance negligible relative to the normal resistance of the wire.

7C-24 Q02A

Bonding connections should be tested for

- A — reactance.
- B — amperage value.
- C — resistance value.

Answer C. JSAT 7-64 (AC43.13-1B)

When a bonding jumper is being made, it should be as short as practicable. It should be installed in such a manner that the resistance of each connection does not exceed .003 ohm.

7C-25 Q02A

If it is necessary to use an electrical connector where it may be exposed to moisture, the mechanic should

- A — coat the connector with grease.
- B — spray the connector with varnish or zinc chromate.
- C — use a special moisture proof type.

Answer C. JSAT 7-61 (AC65-15A)

Electrical connectors are particularly vulnerable to corrosion due to the condensation which can collect in the shell. Special connectors with waterproof features have been developed which can be used to replace non-waterproof plugs in areas where moisture causes a problem.

7C-26 Q02A

If a wire is installed so that it comes in contact with some moving parts, what protection should be given the wire?

- A — Wrap with friction tape.
- B — Pass through conduit.
- C — Wrap with soft wire solder into a shield.

Answer B. JSAT 7-58 (AC43.13-1B AC65-15A)

If an electrical cable, wire bundle, or individual wire might come into contact with some moving part of the aircraft, the wire must be protected by passing it through conduit.

7C-27 Q02A

In the American Wire Gauge (AWG) system of numbers used to designate electrical wire sizes, the number assigned to a size is related to its

- A — cross sectional area.
- B — combined resistance and current carrying capacity.
- C — current carrying capacity.

Answer A. JSAT 7-54 (AC65-15A)

In the American Wire Gauge system, electrical wire size numbers relate to the cross-sectional area of the wire. The way the system works, however, the larger the wire size, the smaller the number size. For example, a number 8 wire is larger than a number 12 wire.

7C-28 Q02A

What is the voltage drop for a No. 18 copper wire 50 feet long to carry 12.5 amperes, continuous operation? Use the formula: $VD = RLA$; VD = Voltage drop; R = Resistance per ft = .00644; L = Length of wire; A = Amperes;

- A — 1/2V.
- B — 1V.
- C — 4V.

Answer C. JSAT 7-54 (AC43.13-1B)

The values given in this question are plugged into the voltage drop formula as follows: Step 1: Resistance per foot (.00644) x 50 feet of wire = .322. Step 2: .322 x the current flow of 12.5 = 4.025 voltage drop.

7C-29 Q02A

Where electric cables must pass through holes in bulkheads, formers, ribs, firewalls, etc., the wires should be protected from chafing by

- A — wrapping with electrical tape.
- B — using a suitable grommet.
- C — wrapping with plastic.

Answer B. JSAT 7-58 (AC65-15A)

Wires and wire groups should be protected against chafing or abrasion in those locations where contact with sharp surfaces or other wires would damage the insulation. Damage to the insulation can cause short circuits, malfunction, or inadvertent operation of equipment. When wires are being passed through holes, it may be necessary to install a rubber grommet to protect the wire from any sharp edges.

7C-30 Q02A

When considering an alteration, the criteria upon which the selection of electric cable size should be based are

- A — current carrying capacity and applied voltage.
- B — current carrying capacity and allowable voltage drop.
- C — applied voltage and allowable voltage drop.

Answer B. JSAT 7-53 (AC65-15A)

The size of electric cable to use is determined by the amount of current it will be asked to carry and the amount of voltage drop which will be allowable.

7C-31 Q03A

What is the maximum amount of time a circuit can be in operation and still be an intermittent duty circuit?

- A — Two minutes.
- B — One minute.
- C — Three minutes.

Answer A. JSAT 7-55

Intermittent duty circuits are those which are operated for only a few seconds or minutes and then are turned off. Examples include the landing gear, flaps, trim motors, landing lights, and emergency hydraulic pumps.

SECTION D

ELECTRICAL SYSTEM COMPONENTS

This section contains information regarding electric motors, circuit protection devices, transformers, and switches.

7D-1 K01A

An electric motor used to raise and lower a landing gear would most likely be a

- A — split field series wound motor.
- B — shunt field series wound motor.
- C — split field shunt wound motor.

Answer A. JSAT 7-81 (AC65-9A)

Because a motor to operate the landing gear needs to be able to reverse its direction of rotation, a split field series wound motor would be used. By using a single-pole, double-throw switch, it is possible to change the direction of current flow through the motor, and thereby change the direction of rotation.

7D-2 Q01A

Some electric motors have two sets of field windings wound in opposite directions so that the

- A — speed of the motor can be more closely controlled.
- B — motor can be operated in either direction.
- C — power output of the motor can be more closely controlled.

Answer B. JSAT 7-81 (AC65-9A)

One method for reversing the direction of rotation of electric motors is to employ two field windings wound in opposite directions on the same pole. A single-pole, double-throw switch makes it possible to direct current through either of the two windings.

7D-3 Q01A

What is the principal advantage of the series wound DC motor?

- A — Suitable for constant speed use.
- B — High starting torque.
- C — Low starting torque.

Answer B. JSAT 7-83 (AC65-9A)

If high starting torque is needed under heavy load conditions, the series wound motor is the best one to use.

7D-4 Q01A

The starting current of a series wound DC motor, in passing through both the field and armature windings, produces a

- A — low starting torque.
- B — speed slightly higher when unloaded.
- C — high starting torque.

Answer C. JSAT 7-83 (AC65-9A)

Because of the low resistance in the windings, the series motor is able to draw a large current in starting. This starting current, in passing through the field and armature windings, produces a high starting torque.

7D-5 Q01A

Which motor would be most likely to have an armature brake?

- A — Inverter drive motor.
- B — Starter motor.
- C — Landing light retraction motor.

Answer C. JSAT 7-82

When a motor needs to have a precise point at which it will stop, an armature brake is utilized. A landing light retraction motor is an application where a precise stopping point is needed.

7D-6 Q01A

How does the magnetic brake used to stop rotation of an electric motor armature operate?

- A — A friction brake is applied by a spring and released by a magnet.
- B — A friction brake is applied by a magnet and released by a spring.
- C — Centrifugal force releases a rotating brake cog from a stationary notch when the armature reaches a certain speed and magnetic force re engages the cog when the electrical power is turned off.

Answer A. JSAT 7-82

An armature magnetic brake consists of a drum mounted on the armature shaft and internal brake shoes, controlled by a magnetizing coil. The coil is placed inside the brake shoes, and when the motor current is turned off, the coil is de-energized and the brake shoes are forced against the drum by spring pressure. Conversely, when the power is turned on, the coil pulls the brake shoes away from the drum.

7D-7 Q01A

A series wound DC electric motor will normally require

- A — more current at high RPM than at low RPM.
- B — approximately the same current throughout its operating range of speed.
- C — more current at low RPM than at high RPM.

Answer C. JSAT 7-83 (AC65-9A)

The load on a series wound motor is highest when the motor is at low RPM. The high load at low RPM causes a high current flow.

7D-8 Q01A

What is the color and orientation of the position lights for navigation on civil airplanes?

- A — Left side - white, right side - green, rear aft - red.
- B — Left side - red, right side - green, rear aft - white.
- C — Left side - green, right side - red, rear aft - white.

Answer B. JSAT 7-73 (AC65-15A)

Navigation lights for civil airplanes are located on the forward tip of the left and right wing tips, and on the tail. The left wing has a red light, the right wing a green light, and the tail a white light.

7D-9 Q01A

When handling a high voltage capacitor in an electrical circuit, be sure it

- A — is fully discharged before removing it from the circuit.
- B — has at least a residual charge before removing it from the circuit.
- C — has a full charge before removing it from the circuit.

Answer A. JSGT 3-105

Capacitors store electricity in an electrostatic field. Large capacitors are capable of storing a charge large enough to injure or kill a person. They should be fully discharged prior to maintenance operations on these systems.

7D-10 Q01A

How can it be determined if a transformer winding has some of its turns shorted together?

- A — The output voltage will be high.
- B — The transformer will get hot in normal operation.
- C — Measure the input voltage with an ohmmeter.

Answer B. JSGT 3-105

It is often difficult to find a shorted transformer winding by measuring its resistance. It is easier to determine whether or not any coils are shorted by feeling the transformer after it has been operating for a while. If any of the windings are shorted, the transformer will be hot.

7D-11 Q01A

Which of the following are the major parts of a DC motor?

1. Armature assembly.
2. Field assembly.
3. Brush assembly.
4. Commutator.
5. Pole piece.
6. Rheostat.
7. End frame.

A — 2, 3, 4, and 5.

B — 3, 5, 6, and 7.

C — 1, 2, 3, and 7.

Answer C. JSAT 7-79 (AC65-9A)

The major parts in a practical motor are the armature assembly, field assembly, brush assembly and end frame.

7D-12 Q01A

- (1) There are three basic types of DC motors; series, shunt, and compound.
(2) In the series motor, the field windings, consisting of relatively few turns of heavy wire, are connected in series with the armature winding.

Regarding the above statements,

- A — only No. 2 is true.
B — both No. 1 and No. 2 are true.
C — only No. 1 is true.

Answer B. JSAT 7-82 (AC65-9A)

The three basic types of DC motors are series motors, shunt motors, and compound motors. The basic series motor has field windings consisting of a relatively few turns of heavy wire, connected in series with the armature winding.

7D-13 Q02A

Aircraft fuse capacity is rated in

- A — volts.
B — amperes.
C — ohms.

Answer B. JSAT 7-70 (AC65-9A)

Fuses are designed to break the connection to a circuit if the current flow is too great. For this reason, fuse capacity is rated in amps.

7D-14 Q02A

When adding a rheostat to a light circuit to control the light intensity, it should be connected in

- A — parallel with the light.
B — series parallel with the light switch.
C — series with the light.

Answer C. JSAT 3-21 (AC65-9A)

A rheostat is a variable resistor used to vary the amount of current flowing in a circuit. In order to control brightness of a light, it would need to be connected in series with the light.

7D-15 Q02A

Circuits that must be operated only in an emergency or whose inadvertent activation could endanger a system frequently employ

- A — guarded switches.
B — push-pull-type circuit breakers only (no switches).
C — spring-loaded to off toggle or rocker switches.

Answer A. JSAT 7-67 (AC43.13-1B AC65-15A)

One way to prevent a switch from being accidentally turned on or off is to install a guard over it. This forces the operator to move the guard before being able to turn the switch on or off, which would ensure that it is not done accidentally.

7D-16 Q02A

If one switch is used to control all navigation lights, the lights are most likely connected

- A — parallel to each other and in series with the switch.
B — in series with each other and in series with the switch.
C — in series with each other and parallel to the switch.

Answer A. JSAT 7-73 (AC65-15A)

Lights in a circuit are connected parallel to each other, so the voltage available to each light will be the same. If one switch is going to control all the lights in the circuit, the switch will need to be in series with the parallel circuit of the lights.

7D-17 Q02A

The nominal rating of electrical switches refers to continuous

- A — current rating with the contacts closed.
B — current rating with the contacts open.
C — voltage rating with the contacts closed.

Answer A. JSAT 7-66 (AC43.13-1B AC65-15A)

The nominal current rating of the conventional aircraft switch is usually stamped on the switch housing and represents the continuous current rating with the contacts closed.

7D-18 Q02A

The navigation lights of some aircraft consist of a single circuit controlled by a single switch which has an ON position and an OFF position, with no additional positions possible. This switch is referred to as a

- A — single pole, single throw (SPST), two position switch.
- B — double pole, single throw (DPST), two position switch.
- C — single pole, double throw (SPDT), two position switch.

Answer A. JSAT 7-67 (AC65-9A)

Electric switches which control a single circuit, and have only an ON and an OFF position, are referred to as single-pole, single-throw, two-position switches. Single-pole means that the switch has only one pole or circuit energized when it is moved to the ON position. Single-throw means that from any position, the switch has only one throw or change of position available to it. Two-position means that the switch has two stopping points — it is either on or off.

7D-19 Q02A

Electric circuits are protected from overheating by means of

- A — thermocouples.
- B — shunts.
- C — fuses.

Answer C. JSAT 7-70 (AC65-9A)

Fuses are current sensitive devices. If the current in a circuit becomes too great, the fuse protecting the circuit will be subjected to the excessive current and it will blow. With excessive current comes excessive heat. When a fuse flows, what it actually does is melt because of the heat.

7D-20 Q02A

What kind of switch should you install in a single wire circuit that required the switch to be manually held in the ON position?

- A — Single pole, single throw (SPST), two position normally open (NO).
- B — Single pole, single throw (SPST), single-position.
- C — Single pole, double throw (SPDT), single-position normally open (NO).

Answer A. JSAT 7-68 (AC65-9A)

A switch installed in a single wire circuit that must be held in the ON position would be a single-pole, single-throw, two-position normally open switch. A switch which stays off, except when held in the ON position, is a normally open switch.

7D-21 Q02A

A circuit breaker is installed in an aircraft electrical system primarily to protect the

- A — circuit and should be located as close to the source as possible.
- B — electrical unit in the circuit and should be located as close to the source as possible.
- C — circuit and should be located as close to the unit as possible.

Answer A. JSAT 7-69 (AC65-15A)

Conductors should be protected with circuit breakers or fuses located as close to the electrical power source bus as possible. Normally, the manufacturer of the electrical equipment specifies the fuse or circuit breaker to be used when installing equipment.

7D-22 Q02A

A circuit protection device called a current limiter is essentially a slow-blow fuse and is designed to be used in

- A — starter-generator circuits.
- B — heavy power circuits.
- C — 400 cycle AC circuits.

Answer B. JSAT 7-70 (AC43.13-1B)

Though a current limiter is often a fuse that is only replaced by maintenance on the ground, it can also be a "slow blow" fuse that is used in high power circuits and allows momentary overloads.

7D-23 Q02A

The three kinds of circuit-protection devices used most commonly in aircraft circuits are

- A — circuit breakers, fuses, and current limiters.
- B — circuit breakers, resistors, and current limiters.
- C — circuit breakers, capacitors, and current limiter plug-ins mechanical reset types.

Answer A. JSAT 7-70 (AC65-9A)

Circuit breakers, fuses, and a type of fuse for large power circuits (current limiter) are used in aircraft.

7D-24 Q02A

What is the purpose of the selection of derated switches for known continuous load current applications?

- A — To calculate the voltage drop across the circuit.
- B — To prevent short circuits in the motor field windings.
- C — To obtain reasonable switch efficiency and service life.

Answer C. JSAT 7-66 (AC65-15A)

Although a switch might be rated for a continuous current load of 15 amps, if the switch is derated and used in a circuit with a current load of only 10 amps, the switch efficiency and service life will be increased.

7D-25 Q02A

What is the advantage of a circuit breaker when compared to a fuse?

- A — Always eliminates the need of a switch.
- B — Never needs replacing.
- C — Resettable and reusable.

Answer C. JSAT 7-70 (AC65-9A)

When a fuse being used to protect an electrical circuit blows, the fuse must be replaced. A big advantage of using circuit breakers instead of fuses is the breaker's ability to be reset and reused. The circuit breaker is, however, considerably more expensive than the fuse.

7D-26 Q02A

What is the advantage of a current limiter?

- A — It can be reset easily.
- B — It breaks circuit quickly.
- C — It will take overload for a short period.

Answer C. JSAT 7-70 (AC65-9A)

Most fuses have a strip of metal (which is designed to melt at a set temperature) made of a tin alloy and bismuth. Some fuses have a metal strip which is made of copper, and they are referred to as current limiters. Current limiters will stand a considerable overload for a short period of time before they will blow.

7D-27 Q02A

In aircraft electrical systems, automatic reset circuit breakers

- A — should not be used as circuit protective devices.
- B — must be used in all circuits essential to safe operation of the aircraft.
- C — are useful where only temporary overloads are normally encountered.

Answer A. JSAT 7-71 (AC43.13-1B)

In an aircraft electrical system, automatic reset circuit breakers should not be used. If a fault exists in a circuit which causes a circuit breaker to trip, the fault needs to be identified before the circuit is powered again. To have a circuit breaker which would continue to reset and then trip could cause serious problems.

7D-28 Q02A

A certain switch is described as a single pole, double throw switch (SPDT). The throw of a switch indicates the number of

- A — circuits each pole can complete through the switch.
- B — terminals at which current can enter or leave the switch.
- C — places at which the operating device (toggle, plunger, etc.) will come to rest and at the same time open or close a circuit.

Answer A. JSAT 7-67 (AC65-9A)

When a switch is described as being a double-throw switch, what is being identified is the number of circuits which can be completed through the switch.

7D-29 Q02A

What is an important factor in selecting aircraft fuses?

- A — The voltage rating should be lower than the maximum circuit voltage.
- B — The current exceeds a predetermined value.
- C — Capacity matches the needs of the circuit.

Answer C. JSAT 7-69 (AC65-9A)

Each aircraft electrical circuit has a requirement in terms of the current flow it will draw. Based on the current flow in the circuit, the device which is installed to protect the circuit (fuse or circuit breaker) will need to be of sufficient capacity.

7D-30 Q02A

The circuit breaker in the instrument lighting system protects the

- A — wiring from too much current.
- B — wiring from too much voltage.
- C — lights from too much current.

Answer A. JSAT 7-69 (AC65-9A)

Circuit breakers are designed to protect an electrical system from too much current flow. In an instrument lighting system, it is the wiring which is protected from excessive current.

7D-31 Q03A

Why are the iron cores of most induction coils laminated?

- A — To reduce the effects of eddy currents.
- B — To increase the core permeability.
- C — To reduce the core reluctance.

Answer A. JSGT 4-35

The primary windings of an induction coil consist of relatively few turns of large wire and will carry sufficient current to set up a strong magnetic field through the soft iron core. The core consists of thin iron laminations or insulated iron wires bound together in the shape and size desired. This type of construction reduces the effects of the eddy currents induced in the core.

7D-32 Q03A

The voltage in an AC transformer secondary that contains twice as many loops as the primary will be

- A — greater and the amperage less than in the primary.
- B — less and the amperage greater than in the primary.
- C — greater and the amperage greater than in the primary.

Answer A. JSGT 3-54 (AC65-9A)

Transformers, whether AC or DC, cannot produce power. Their output power, if they are 100% efficient, will be the same as the input power. Since power is the product of the voltage and the current, if a transformer is stepping up the voltage, it is stepping down the current. A transformer secondary with more loops than the primary steps up the voltage, and steps down the current.

7D-33 Q03A

How can the direction of rotation of a DC electric motor be changed?

- A — Interchange the wires which connect the motor to the external power source.
- B — Reverse the electrical connections to either the field or armature windings.
- C — Rotate the positive brush one commutator segment.

Answer B. JSAT 7-81 (AC65-9A)

The direction a motor will turn is determined by the direction of current flow in either the armature or the field windings. By reversing either of these current flows, the direction of rotation will be reversed.

7D-34 Q03A

During inspection of an anticollision light installation for condition and proper operation, it should be determined that

- A — electrical or mechanical interconnections are provided so that the anticollision light will operate at all times that the position light switch is in the ON position.
- B — an appropriately rated fuse is in position at the light to protect the connecting wiring against electrical faults.
- C — the anticollision light can be operated independently of the position lights.

Answer C. (AC43.13-2A)

According to AC43.13-2A, when an anticollision light is installed, a switch needs to be used which is independent of the position light system switch.

7D-35 Q03A

A relay is

- A — a magnetically operated switch.
- B — any conductor which receives electrical energy and passes it on with little or no resistance.
- C — a device which converts electrical energy to kinetic energy.

Answer A. JSAT 7-68 (AC65-9A)

A relay switch consists of a coil, or solenoid, an iron core, and both fixed and movable contacts. When the solenoid is energized (powered), it creates a magnetic force which pulls the movable contact down until it touches the fixed contact, which completes the circuit.

7D-36 R02A

Microswitches are used primarily as limit switches to

- A — prevent overcharging of a battery.
- B — control electrical units automatically.
- C — limit generator output.

Answer B. JSAT 7-68 (AC65-9A)

Microswitches are used primarily as limit switches to provide automatic control of electrical units. They are used to limit the movement of a mechanism.

7B-37 Q03A

What is the ratio of turns between the primary coil winding and the secondary coil winding of a transformer designed to triple its input voltage?

- A — Primary will have twice as many turns as its secondary.
- B — Primary will have one third as many turns as its secondary.
- C — Primary will have three times as many turns as its secondary.

Answer B. JSGT 3-54 (AC65-9A)

In a transformer, the ratio between the number of turns in the primary and the voltage in the primary is directly proportional to the ratio between the number of turns in the secondary and voltage in the secondary. If the secondary has three times as much voltage as the primary it will have three times as many turns.

HYDRAULIC AND PNEUMATIC POWER SYSTEMS

CHAPTER

8

SECTION A PRINCIPLES OF HYDRAULIC POWER

This section contains information regarding principles of hydraulics, and basic hydraulic system maintenance practices.

8A-1 K01A

A hydraulic hose identified as MIL-H-8794 will have a yellow stripe running the length of the hose. This stripe

- A — identifies that the hose is constructed of synthetic rubber and may be suitable for a wide range of applications.
- B — identifies that the hose is for hydraulic fluid only.
- C — is used to ensure that the hose is installed without excessive twisting.

Answer C. JSJT 10-15

Aircraft flexible hose is marked with a yellow, red, or white stripe running the length of the hose, called a lay line. This lay line is not only for identification of the hose, but it serves to indicate whether or not the line was twisted when it was installed.

8A-2 L01A

The removal of air from an aircraft hydraulic system is generally accomplished

- A — through automatic bleed valves on individual components during system operation.
- B — by allowing the system to remain inoperative for several hours.
- C — by operating the various hydraulic components through several cycles.

Answer C. JSJS 88

The easiest way to remove air from an aircraft hydraulic system is to operate various hydraulic components (often the flaps) until air is no longer heard in the system.

8A-3 L01A

Which characteristics apply to aircraft hydraulic systems?

1. Minimum maintenance requirements.
2. Lightweight.
3. About 80 percent operating efficiency (20 percent loss due to fluid friction).
4. Simple to inspect.

A — 1, 2, 3, and 4.

B — 1, 2, and 4.

C — 1, 3, and 4.

Answer B. JSAT 8-2 (AC65-15A)

Hydraulic systems combine the advantages of light weight, ease of installation, simplification of inspection, and minimum maintenance requirements. Hydraulic operations are nearly 100% efficient.

8A-4 L02A

Which statement about fluids is correct?

- A — All fluids are considered to be highly compressible.
- B — Any fluid will completely fill its container.
- C — All fluids readily transmit pressure.

Answer C. JSAT 8-2 (AC65-9A)

Gases and liquids are both fluids. Although there are many differences between the characteristics of the two, one characteristic that all fluids have is their ability to readily transmit pressure. Liquids do a better job of transmitting pressure, however, because they are for all practical purposes, incompressible.

8A-5 L03A

Pressure is a term used to indicate the force per unit area. Pressure is usually expressed in

A — pounds per inch.

B — pounds per square inch.

C — pounds per cubic inch.

Answer B. JSAT 8-2 (AC65-9A)

Pressure is a measure of the amount of force that acts on a unit of area. In most American designed hydraulic systems, pressure is measured in pounds per square inch.

8A-6 L03A

If two actuating cylinders which have the same cross sectional area but different lengths of stroke are connected to the same source of hydraulic pressure, they will exert

- A — different amounts of force but will move at the same rate of speed.
- B — equal amounts of force and will move at the same rate of speed.
- C — equal amounts of force but will move at different rates of speed.

Answer B. JSAT 8-3 — 8-5 (AC65-9A)

According to Pascal's Law, the force available at a piston is equal to the cross sectional area of the piston multiplied by the pressure acting on it. The length of stroke of two pistons has no effect on how much force they will exert or the speed at which they will move.

8A-7 L03A

Using a hand pump, pressure of 100 PSI has been built up in a hydraulic system. The hand pump piston is 1 inch in diameter. A 1/2-inch line connects the hand pump to an actuating cylinder 2 inches in diameter. What is the pressure in the line between the hand pump and the actuator?

- A — 150 PSI.
- B — 100 PSI.
- C — 200 PSI.

Answer B. JSAT 8-2 (AC65-9A)

According to Pascal's Law, pressure in an enclosed hydraulic system is equal and undiminished in all directions. In this question, the fact that there is 100 PSI in one part of the system means that there is 100 PSI in all parts of the system. This holds true because this is not a complex system making use of pressure reducing devices.

8A-8 L03A

A crossflow valve which is designed to bypass fluid from one side of an actuating cylinder to the other side, under certain conditions, may be found in some aircraft installed in the

- A — flap overload system.
- B — landing gear system.
- C — engine cowl flap system.

Answer B. JSAT 9-14

A crossflow valve is used in the landing gear system of some aircraft to connect both sides of the landing gear actuating cylinder. When the landing gear is being lowered, its weight might cause the gear to extend more rapidly than fluid can be supplied to the cylinder. By connecting the two sides of the cylinder, fluid is allowed to flow from one side of the cylinder to the other, ensuring smooth operation. The crossflow valve is also known as a free-fall valve. As a free-fall valve, it allows the retraction side of the cylinder, which has fluid trapped in it under pressure, to be connected with the extension side of the cylinder. This is done if the system malfunctions and an emergency extension of the gear is needed.

SECTION B

HYDRAULIC SYSTEM COMPONENTS AND DESIGN

Section B of Chapter 8 contains information regarding Hydraulic seals, fluids, hoses, and basic hydraulic system design requirements.

8B-1 L01A

To prevent external and internal leakage in aircraft hydraulic units, the most commonly used type of seal is the

- A — O-ring seal.
- B — gasket seal.
- C — chevron seal.

Answer A. JSGT 7-25 (AC65-9A)
The most commonly used two way seal is the O-ring, which may be used as either a gasket or a packing.

8B-2 L01A

What type of packings should be used in hydraulic components to be installed in a system containing Skydrol?

- A — AN packings made of neoprene.
- B — Packing materials made for ester base fluids.
- C — AN packings made of natural rubber.

Answer B. JSAT 8-8 (AC65-15A)
Skydrol® hydraulic fluid is a phosphate ester base fluid, so the packing materials used with this type of fluid must be compatible with an ester base.

8B-3 L01A

What is the purpose of using backup rings with O-rings in hydraulic systems above 1,500 PSI?

- A — Prevent high pressure from extruding the seal between the moving and stationary part.
- B — Provide a seal between two parts of a unit which move in relation to each other.
- C — Prevent internal and external leakage of all moving parts within a hydraulic system.

Answer A. JSGT 7-25 (AC65-9A)
An O-ring of the appropriate size can withstand pressures of up to about 1500 PSI without distortion. Beyond this, however, there is a tendency for the O-ring to extrude into the groove between the two mating surfaces. To prevent this, an anti-extrusion or backup ring should be used.

8B-4 L01A

The installation of a new metal hydraulic line should be made with

- A — a straight tube to withstand the shocks and vibration to which it will be subjected.
- B — enough bends to allow the tube to expand and contract with temperature changes and to absorb vibration.
- C — a straight tube to permit proper alignment of the fitting and thereby reduce fluid loss through leakage.

Answer B. JSGT 10-11
All tubing should have at least one bend when it is installed to absorb the strains from vibration and from the dimensional changes of the aircraft structure due to temperature changes.

8B-5 L01A

Extrusion of an O-ring seal is prevented in a high pressure system by the use of a

- A — backup ring on the side of the O-ring next to the pressure.
- B — U ring on the side of the O-ring away from the pressure.
- C — backup ring on the side of the O-ring away from the pressure.

Answer C. JSGT 7-25

Extrusion of O-ring material under high pressure can be effectively stopped by using a backup ring placed on the side away from the pressure. Check the angle cuts on the backup ring for proper overlap.

8B-6 L01A

A flexible sealing element subject to motion is a

- A — gasket.
- B — compound.
- C — packing.

Answer C. JSAT 8-42 (AC65-9A)

Packings are made of synthetic or natural rubber. They are generally used as "running" seals, that is, in units that contain moving parts, such as actuating cylinders, pumps, selector valves, etc.

8B-7 L01A

If a rigid tube is too short for the flare to reach its seat before tightening, pulling it into place by tightening

- A — may distort the flare.
- B — is acceptable.
- C — may distort the cone.

Answer A. JSGT 10-10

Rigid tubing should have at least one bend, and should be fabricated so that it is not necessary to "pull" the tube into alignment. Pulling the tube into place may distort the flare.

8B-8 L01A

(Refer to Airframe figure 11) Which fitting is an AN flared tube fitting?

- A — 1.
- B — 3.
- C — 2.

Answer A. JSGT 10-8 (AC65-9A)

The AN fitting has a recess (unthreaded portion) between the flare angle and the threads. The AC fitting has no such recess. The AN fitting also has coarser threads.

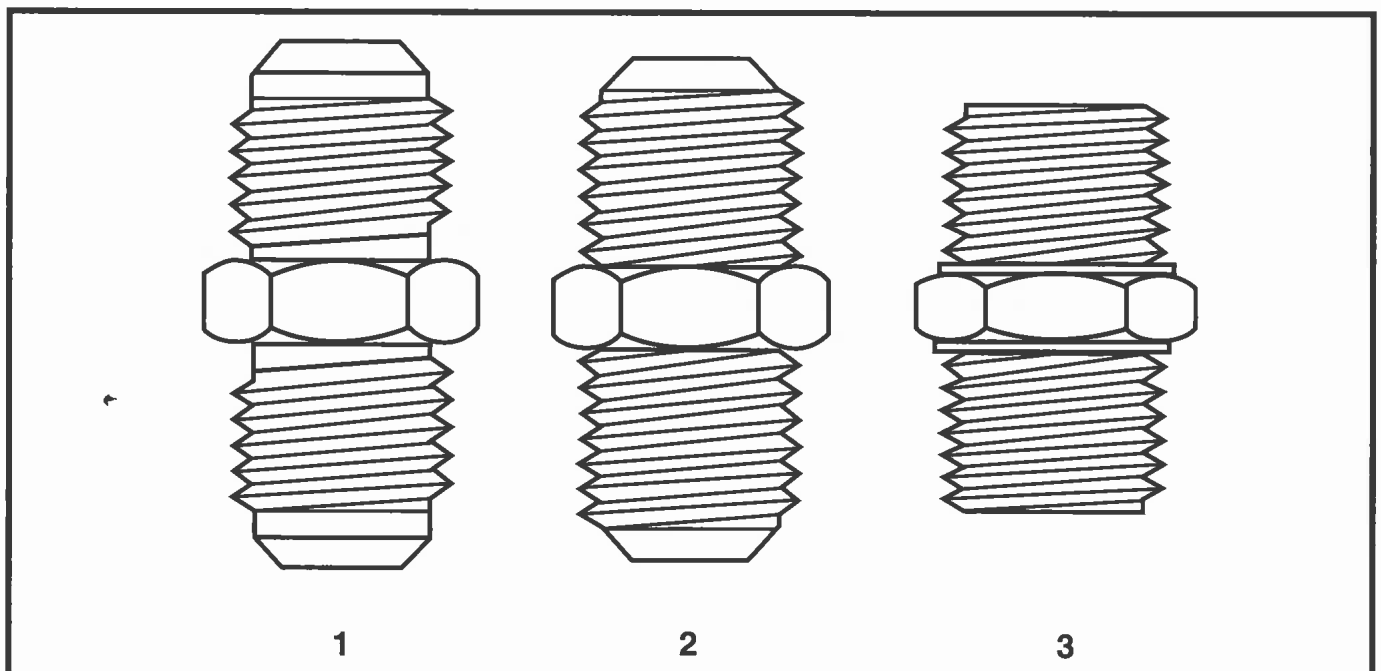


Figure 11.

8B-9 L01A

(Refer to Airframe figure 12) Which illustration(s) show(s) the correct spiral for teflon backup rings?

- A — 1 and 2.
- B — 1 and 3.
- C — 3.

Answer B. JSAT 8-44

Illustration 2 would cause a "hump" in the compressed O-ring and a shearing tendency in the backup ring. Illustration 1 is correct and under pressure takes on the appearance of Illustration 3.

8B-10 L02A

If a hydraulic brake system uses neoprene rubber packing materials, the correct hydraulic fluid to service the system is

- A — mineral base oil.
- B — phosphate ester base oil.
- C — vegetable base oil.

Answer A. JSAT 8-7 (AC65-15A)

Neoprene seals and hoses are used with mineral-based fluids.

8B-11 L02A

The internal resistance of a fluid which tends to prevent it from flowing is called

- A — volatility.
- B — viscosity.
- C — acidity.

Answer B. JSAT 8-6 (AC65-15A)

One of the most important properties of any hydraulic fluid is its viscosity. Viscosity is internal resistance to flow.

8B-12 L02A

What is the viscosity of hydraulic fluid?

- A — The internal resistance of a fluid which tends to prevent it from flowing.
- B — The increase in volume of a fluid due to temperature change.
- C — The fluid's ability to resist oxidation and deterioration for long periods.

Answer A. JSAT 8-6 (AC65-15A)

Viscosity is internal resistance to flow.

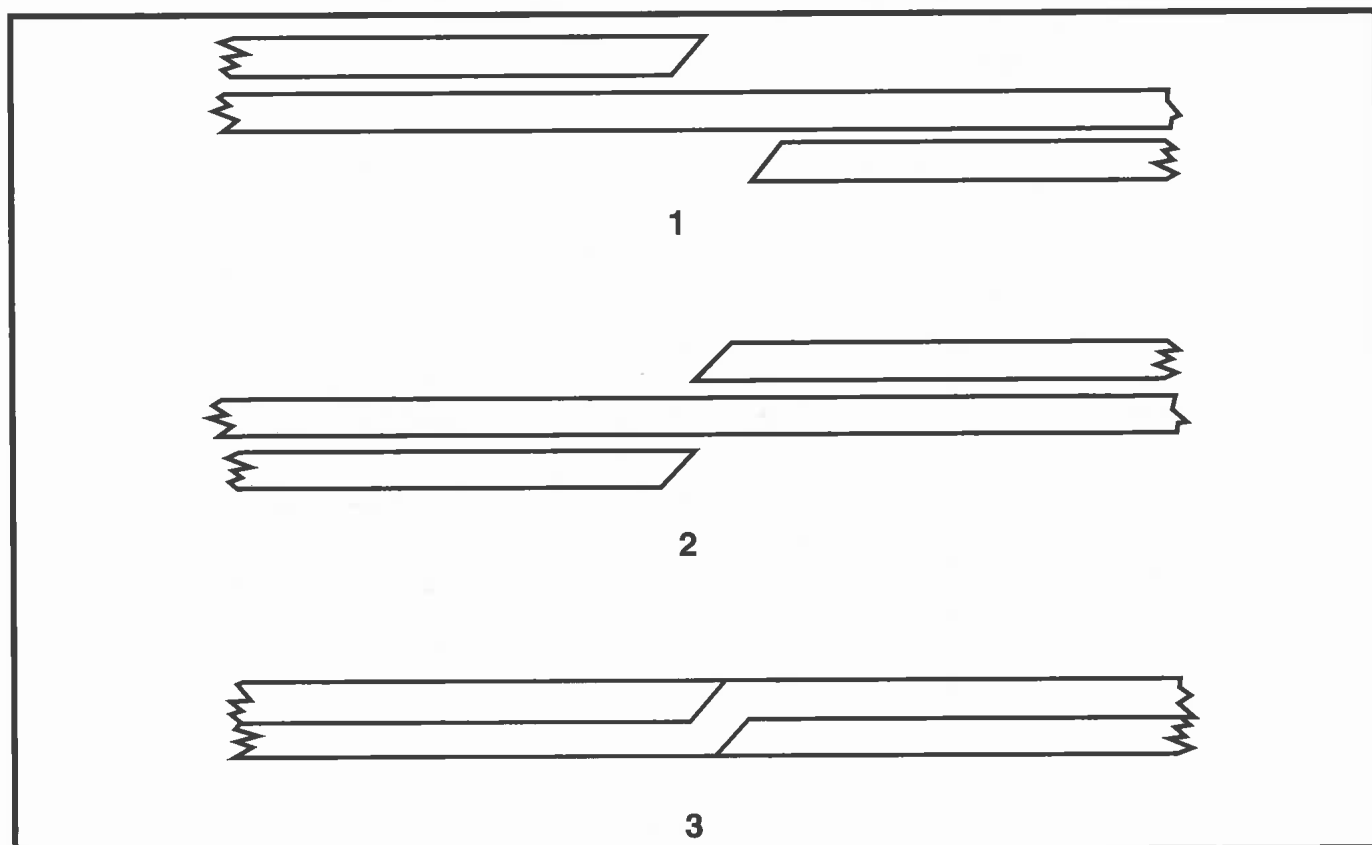


Figure 12.

8B-13 L02A

Which is a characteristic of petroleum base hydraulic fluid?

- A — Nonflammable under all conditions.
- B — Flammable under normal conditions.
- C — Compatible to natural rubber seals and packings.

Answer B. JSAT 8-7 (AC65-15A)
Mineral base hydraulic fluid is processed from petroleum. This type of fluid is flammable.

8B-14 L02A

- (1) When servicing aircraft hydraulic systems, use the type fluid specified in the aircraft manufacturer's maintenance manual or on the instruction plate affixed to the reservoir or unit.
- (2) Hydraulic fluids for aircraft are dyed a specific color for each type of fluid. Regarding the above statements,

- A — only No. 1 is true.
- B — only No. 2 is true.
- C — both No. 1 and No. 2 are true.

Answer C. JSAT 8-7 (AC65-15A)
To assure proper system operation and to avoid damage to nonmetallic components of the hydraulic system, the correct fluid must be used. When adding fluid to a system, use the type specified in the aircraft manufacturer's maintenance manual or on the instruction plate affixed to the reservoir or unit being serviced. To avoid servicing with the wrong type of fluid, each type of fluid is dyed a certain color.

8B-15 L02A

Petroleum base hydraulic fluid is which color?

- A — Purple.
- B — Red.
- C — Blue.

Answer B. JSAT 8-7 (AC65-15A)
Mineral based hydraulic fluid is processed from petroleum. It has an odor similar to penetrating oil and is dyed red.

8B-16 L02A

Which of the following is adversely affected by atmospheric humidity if left unprotected?

- 1. MIL-H-5606 hydraulic fluid.
- 2. Skydrol hydraulic fluid.
- 3. None of the above.

- A — 2.
- B — 1 and 2.
- C — 3.

Answer A. JSAT 8-8
Skydrol is quite susceptible to contamination by water from the atmosphere, and must be kept tightly sealed.

8B-17 L02A

Which is a characteristic of synthetic base hydraulic fluid?

- A — Low flash point.
- B — Low moisture retention.
- C — High flash point.

Answer C. JSAT 8-8 (AC65-15A)
Skydrol® fluid has a very high flash point. Even though it might flash at exceedingly high temperatures, Skydrol fluid will not tend to spread fire.

8B-18 L02A

Two types of hydraulic fluids currently being used in civil aircraft are

- A — mineral base, and phosphate ester base.
- B — mixed mineral base and phosphate ester base.
- C — petroleum base and mixed mineral base.

Answer A. JSAT 8-7 (AC65-15A)
There are three types of hydraulic fluid currently being used in civil aircraft: vegetable, mineral, and phosphate ester base.

8B-19 L02A

Which of the following lists only desirable properties of a good hydraulic fluid?

- A — High viscosity, low flash point, chemical stability, high fire point.
- B — Low viscosity, chemical stability, high flash point, high fire point.
- C — High flash point, low viscosity, chemical stability, low fire point.

Answer B. JSAT 8-6 (AC65-15A)

A good hydraulic fluid has a low viscosity, good chemical stability, high flash point, and high fire point.

8B-20 L02A

Characteristics of MIL-H-8446 (Skydrol 500 A & B) hydraulic fluid are

- A — blue color, phosphate ester base, fire resistant, butyl rubber seals.
- B — light purple color, phosphate ester base, fire resistant, butyl rubber seals.
- C — light green color, phosphate ester base, fire resistant, butyl rubber seals.

Answer B. JSAT 8-8 (AC65-15A)

Skydrol® 500 A and B hydraulic fluids are phosphate ester base synthetics, light purple in color, fire resistant, and are used with butyl rubber seals.

8B-21 L02A

Where can information be obtained about the compatibility of fire resistant hydraulic fluid with aircraft materials?

- A — Manufacturer's technical bulletins.
- B — Aircraft manufacturer's specifications.
- C — AC 43.13-1A.

Answer A. JSAT 8-8 (AC65-15A)

Manufacturer's technical bulletins will generally give information about the compatibility of aircraft materials with different types of hydraulic fluid.

8B-22 L02A

Characteristics of MIL-H-5606 hydraulic fluid are

- A — light purple color, phosphate ester base, fire resistant, uses butyl rubber seals.
- B — blue color, will burn, uses natural rubber seals.
- C — red color, petroleum base, will burn, uses synthetic rubber seals.

Answer C. JSAT 8-7 (AC65-15A)

5606 hydraulic fluid is processed from petroleum, it is red in color, it is flammable, and it is used with synthetic rubber seals.

8B-23 L02A

Characteristics of MIL-H-7644 hydraulic fluid are

- A — blue color, vegetable base, will burn, natural rubber seals.
- B — light purple color, phosphate ester base, fire resistant, butyl rubber seals.
- C — red color, petroleum base, will burn, synthetic rubber seals.

Answer A. JSAT 8-7 (AC65-15A)

7644 hydraulic fluid is a vegetable base, it is blue in color, it is flammable, and it is used with natural rubber seals.

8B-24 L02A

If an aircraft hydraulic system requires mineral base hydraulic fluid, but phosphate ester base hydraulic fluid is used, what will be the effect on the system?

- A — System will be contaminated, fluids will not blend, and the seals will fail.
- B — No effect.
- C — System will be contaminated, fluids will not blend, but there will be no seal problem.

Answer A. JSAT 8-7 (AC65-15A)

When servicing a system using Skydrol® hydraulic fluid, care must be taken to use only seals and hoses having the proper part number. Components which are compatible with mineral or vegetable base fluids will be damaged by the synthetic fluid.

8B-25 L02A

What is used to flush a system normally serviced with MIL-H-5606 hydraulic fluid?

- A — Naphtha or varsol.
- B — Lacquer thinner or trichloroethylene.
- C — Methyl ethyl ketone or kerosene.

Answer A. JSAT 8-7

A hydraulic system that uses mineral base hydraulic fluid can be flushed with naphtha, Varsol®, or Stoddard® solvent.

8B-26 L02A

Components containing phosphate ester-base hydraulic fluid may be cleaned with

- A — Naphtha.
- B — Carbon tetrachloride.
- C — Stoddard® solvent.

Answer C.

Components containing Skydrol® fluid can be cleaned with Stoddard solvent and air dried.

8B-27 L02A

How can the proper hydraulic fluid to be used in an airplane be determined?

- A — Consult the aircraft manufacturer's service manual.
- B — Refer to the aircraft parts manual.
- C — Consult the aircraft Type Certificate Data Sheet.

Answer A. JSAT 8-7

When servicing a hydraulic system, be sure that only the proper fluid is used. The service manual of the airplane specifies the fluid, and the reservoir should also be marked with the type of fluid required.

8B-28 L02A

Phosphate ester base hydraulic fluid is very susceptible to contamination from

- A — ethylene propylene elastomers.
- B — teflon seal material.
- C — water in the atmosphere.

Answer C. JSAT 8-8

Some compounds will actually attract water from the air. Skydrol® is one of these.

8B-29 L02A

- (1) Materials which are Skydrol® compatible or resistant include most common aircraft metals and polyurethane and epoxy paints.
- (2) Skydrol® hydraulic fluid is compatible with nylon and natural fibers.

Regarding the above statements,

- A — both No. 1 and No. 2 are true.
- B — only No. 1 is true.
- C — neither No. 1 nor No. 2 is true.

Answer A. JSAT 8-8 (AC65-15A)

Skydrol® does not appreciably affect common aircraft metals - aluminum, zinc, magnesium, iron, silver, cadmium. Paints which are Skydrol® resistant include epoxies and polyurethanes. Skydrol® is compatible with natural fibers and a number of synthetics, including nylon and polyester.

8B-30 L03A

Which seals are used with petroleum base hydraulic fluids?

- A — Buna-N.
- B — Butyl rubber.
- C — Polyester.

Answer A. JSAT 8-7 (AC65-15A)

Seals used with petroleum base hydraulic fluid are made of synthetic rubbers such as Neoprene and Buna-N.

8B-31 L03A

Which seal/material is used with phosphate ester base hydraulic fluids?

- A — Silicone rubber.
- B — Neoprene rubber.
- C — Butyl rubber.

Answer C. JSAT 8-8

Synthetic rubber such as Butyl is used with the fire-resistant phosphate ester base hydraulic fluids.

8B-32 L03A

One of the main advantages of skydrol is it's

- A — wide operating temperature.
- B — inability to mix with water.
- C — high operating pressure.

Answer A. JSAT 8-8 (AC65-9A)

One of the main advantages of Skydrol is that it sustains operation at a wide range of operating temperatures.

8B-33 L03A

Hydraulic system thermal relief valves are set to open at a

- A — lower pressure than the system pressure regulator.
- B — lower pressure than the system relief valve.
- C — higher pressure than the system relief valve.

Answer C. JSAT 8-35 (AC65-15A)

Thermal relief valves are used to relieve excessive pressures that may exist due to thermal expansion of the fluid. They are adjusted to pressures which are above those required for the operation of the systems or the other relief valves, so they do not interfere with normal operation.

8B-34 L03A

Although dents in the heel of a bend are not permissible, they are acceptable in the remainder of a hydraulic tube providing they are less than what percent of the tube diameter?

- A — 10.
- B — 20.
- C — 5.

Answer B. JSGT 10-12 (AC43.13-1B)

AC 43.13-1B changes indicate that a dent less than 20% of the tube diameter is not objectionable unless it is in the heel of the bend.

8B-35 L03A

A common cause of slow actuation of hydraulic components is

- A — restricted orifices.
- B — internal leakage in the actuating unit.
- C — cold fluid.

Answer B. JSHS 87

Slow actuation of a unit is often caused by internal leakage in a valve or actuator.

8B-36 L03A

Teflon hose that has developed a permanent set from being exposed to high pressure or temperature should

- A — not be straightened or bent further.
- B — not be reinstalled once removed.
- C — be immediately replaced.

Answer A. JSGT 10-14 (AC43.13-1B)

Teflon® has peculiar characteristics that require extra care in handling. It tends to assume a permanent set when exposed to high temperatures and pressures. Do not attempt to straighten a hose that has been in service.

8B-37 L03A

If an aircraft's constant pressure hydraulic system cycles more frequently than usual and no fluid leakage can be detected, the most probable cause is

- A — low accumulator air preload.
- B — pump volume output too high.
- C — a too high relief valve setting.

Answer A. JSAT 8-37 (AC65-15A)

One function of the accumulator in a hydraulic system is to supply fluid under pressure to compensate for small internal or external leaks which would cause the system to cycle continuously by action of the pressure switches continually "kicking in". If the air preload in the accumulator is low, it won't be able to handle any draw down on the system and the pump will be continually cycling.

8B-38 L03A

Excluding lines, which components are required to make up a simple hydraulic system?

- A — Pump, reservoir, relief valve, and shuttle valve.
- B — Actuator, pressure reservoir, accumulator, and selector valve.
- C — Pump, reservoir, selector valve, and actuator.

Answer C. JSAT 8-11 (AC65-15A)

A basic hydraulic system needs a reservoir to hold the fluid, a pump to impart pressure to the fluid, a selector valve to direct the fluid, and an actuator to transform the fluid pressure to mechanical force.

8B-39 L03A

Quick disconnect couplings in hydraulic systems provide a means of

- A — easily replacing hydraulic lines in areas where leaks are common.
- B — quickly connecting and disconnecting hydraulic lines and eliminate the possibility of contaminants entering the system.
- C — quickly connecting and disconnecting hydraulic lines without loss of fluid or entrance of air into the system.

Answer C. JSAT 8-32

Hydraulic quick disconnect fittings are normally found on components that are frequently removed and reinstalled for maintenance and inspection. They allow the lines to be quickly connected or disconnected without loss of fluid or entrance of air into the system.

8B-40 L03A

How many of these seals are used with petroleum base hydraulic fluids?

- 1. Synthetic rubber.
- 2. Natural rubber.
- 3. Neoprene rubber.

- A — Two.
- B — One.
- C — Three.

Answer A. JSAT 8-44, JSHS 9 (AC65-15A)
Synthetic rubber seals and neoprene seals are used with petroleum base hydraulic fluids. The technician must be very careful to only use the proper type seal with each type of hydraulic fluid.

SECTION C

HYDRAULIC POWER SYSTEMS

Section C of Chapter 8 includes information regarding hydraulic system pumps, valves, accumulators, and other hydraulic system components.

8C-1 K01A

What device in a hydraulic system with a constant delivery pump allows circulation of the fluid when no demands are on the system?

- A — Pressure regulator.
- B — Pressure relief valve.
- C — Shuttle valve.

Answer A. JSAT 8-23 (AC65-15A)

When a constant-delivery pump is used in a hydraulic system in which the pressure must be kept at a constant value, a pressure regulator is required. This pressure regulator discharges fluid from the pressure line into a reservoir return line when the pressure exceeds the predetermined maximum for which the valve is adjusted. This valve also unloads the pump when the pressure in the system is within normal operating parameters.

8C-2 K01A

A fully charged hydraulic accumulator provides

- A — positive fluid flow to the pump inlet.
- B — a source for additional hydraulic power when heavy demands are placed on the system.
- C — air pressure to the various hydraulic components.

Answer B. JSAT 8-36 (AC65-15A)

The function of an accumulator is to dampen pressure surges, to aid or supplement the power pump when several units are operating, to store power for the limited operation of the system when the pump is not running, and to supply fluid under pressure to compensate for small internal or external leaks.

8C-3 K01A

A hydraulic system referred to as a “power pack” system will

- A — have an engine driven pump for greater pressure.
- B — have all hydraulic power components located in one unit.
- C — have a pressurized reservoir.

Answer B. JSAT 8-15

To continue the simplification of the hydraulic systems, many manufacturers use an electric motor to drive the hydraulic pump and incorporate it with the necessary valves and reservoir into a single unit. This unit is typically called a “power pack”.

8C-4 K01A

An O-ring intended for use in a hydraulic system using MIL-H-5606 (mineral base) fluid will be marked with

- A — one or more white dots.
- B — a blue stripe or dot.
- C — a white and yellow stripe.

Answer B. JSAT 8-44

The part number is the only sure way of knowing that the correct O-ring is being used, but most rings are also marked with a series of colored dots or stripes to indicate the type of fluid with which they are compatible. A blue dot or stripes indicates compatibility with MIL-H-5606 hydraulic fluid.

8C-5 K01A

What condition would most likely cause excessive fluctuation of the pressure gauge when the hydraulic pump is operating?

- A — Inadequate supply of fluid.
- B — Accumulator air pressure low.
- C — System relief valve sticking closed.

Answer A. JSHS 88

Excessive fluctuation of hydraulic pressure is a sure sign of inadequate supply of fluid. Sometimes fluctuation can be due to air in the gauge lines.

8C-6 K01A

A filter incorporating specially treated cellulose paper is identified as a

- A — sediment trap.
- B — cuno filter.
- C — micronic filter.

Answer C. JSAT 8-20 (AC65-15A)

One of the more efficient types of filters used in aircraft hydraulic systems is made of specially treated paper folded into pleats to increase its surface area. This pleated paper micronic element, as it is called, is wrapped around a spring steel wire coil to prevent its collapsing.

8C-7 K01A

The purpose of an orifice check valve is to

- A — restrict flow in one direction and allow free flow in the other.
- B — relieve pressure to a sensitive component.
- C — relieve pressure in one direction and prevent flow in the other direction.

Answer A. JSAT 8-30 (AC65-15A)

There are many instances in an aircraft hydraulic system when it is desirable to allow fluid to flow in one direction but prevent its flow in the opposite direction. This can be done by using check valves. An orifice check valve restricts flow in one direction and allows free flow in the other.

8C-8 L01A

To protect packing rings or seals from damage when it is necessary to install them over or inside threaded sections, the

- A — packings should be stretched during installation to avoid contact with the threads.
- B — threaded section should be covered with a suitable sleeve.
- C — threaded section should be coated with a heavy grease.

Answer B. JSAT 8-46 (AC43.13-1B)

When installing an O-ring over a sharp edge or threads, you should cover the sharp portion with paper, aluminum foil, brass shim stock, or with a piece of plastic.

8C-9 L01A

Which allows free fluid flow in one direction and no fluid flow in the other direction?

- A — Check valve.
- B — Metering piston.
- C — Shutoff valve.

Answer A. JSAT 8-29 (AC65-15A)

There are many instances in an aircraft hydraulic system where it is desirable to allow fluid to flow in one direction but prevent its flow in the opposite direction. This can be done by using check valves.

8C-10 L01A

Select the valve used in a hydraulic system that directs pressurized fluid to one end of an actuating cylinder and simultaneously directs return fluid to the reservoir from the other end.

- A — Sequence.
- B — Shuttle.
- C — Selector.

Answer C. JSAT 8-28 (AC65-15A)

Selector valves are used to control the direction of movement of an actuating unit. A selector valve provides a pathway for the simultaneous flow of hydraulic fluid into and out of a connected actuating unit.

8C-11 L01A

- (1) Relief valves are used in pneumatic systems as damage preventing units.
(2) Check valves are used in both hydraulic and pneumatic systems. Regarding the above statements,

A — only No. 1 is true.
B — neither No. 1 nor No. 2 is true.
C — both No. 1 and No. 2 are true.

Answer C. JSAT 8-29, JSAT 8-53 (AC65-15A)
Relief valves are used in pneumatic systems to prevent damage. They act as pressure-limiting units and prevent excessive pressures from bursting lines and blowing out seals. Check valves are used in both pneumatic and hydraulic systems to limit the flow to one direction.

8C-12 L01A

One of the distinguishing characteristics of an open center selector valve used in a hydraulic system is that

- A — fluid flows through the valve in the OFF position.
B — a limited amount of fluid flows in one direction and no fluid flows in the opposite direction.
C — fluid flows in three directions in the ON position.

Answer A. JSAT 8-28
In an open center-type of selector valve, when the valve is in the OFF or neutral position, fluid flows straight through the valve from the pump and on to the next selector valve or back to the reservoir.

8C-13 L01A

The component in the hydraulic system that is used to direct the flow of fluid is the

- A — check valve.
B — orifice check valve.
C — selector valve.

Answer C. JSAT 8-28 (AC65-15A)
Selector valves are used to control the direction of movement of an actuating unit. A selector valve provides a pathway for the simultaneous flow of hydraulic fluid into and out of a connected actuating unit.

8C-14 L01A

What type of selector valve is one of the most commonly used in hydraulic systems to provide for simultaneous flow of fluid into and out of a connected actuating unit?

- A — Three port, four way valve.
B — Four port, closed center valve.
C — Two port, open center valve.

Answer B. JSAT 8-28 (AC65-15A)
The four-way closed-center selector valve is one of the most commonly used selector valves in an aircraft hydraulic system. In this type of valve, when the selector is OFF, all of the valve ports are blocked and fluid cannot flow into or out of the valve.

8C-15 L01A

The purpose of the pressure regulator in a hydraulic system is to

- A — prevent failure of components or rupture of hydraulic lines under excessive pressure.
B — regulate the amount of fluid flow to the actuating cylinders within the system.
C — maintain system operating pressure within a predetermined range and to unload the pump.

Answer C. JSAT 8-35 (AC65-15A)
One purpose of a pressure regulator is to manage the output of the pump to maintain system operating pressure within a predetermined range. The other purpose is to permit the pump to turn without resistance (termed unloading the pump) at times when pressure in the system is within normal operating range.

8C-16 L01A

What is one advantage of piston type hydraulic motors over electric motors?

- A — They work satisfactorily over a wider temperature range.
- B — There is no fire hazard if the motor is stalled.
- C — They are considerably quieter in operation.

Answer B. JSAT 8-42, JSHS 56 (AC65-15A)
Piston-type hydraulic motors have many applications on larger aircraft where it is desirable to have a considerable amount of power with good control, the ability to instantaneously reverse the direction of rotation, and no fire hazard if the motor is stalled.

8C-17 L01A

Generally, the first step in removing an accumulator from an aircraft is to

- A — drain the reservoir.
- B — relieve system pressure.
- C — discharge the preload.

Answer B. JSAT 8-37
Before removing any component in a hydraulic system, the system pressure must be relieved. Some systems utilize a pressurized reservoir. Always check the manufacturer's maintenance manual instructions for the removal of components. Before disassembling an accumulator, make sure that the preload pressure has been discharged.

8C-18 L03A

The primary purpose of a hydraulic actuating unit is to transform

- A — fluid pressure into useful work.
- B — fluid motion into mechanical pressure and back again.
- C — energy from one form to another.

Answer A. JSAT 8-39 (AC65-15A)
An actuating cylinder transforms energy in the form of fluid pressure into mechanical force, or action, to perform work.

8C-19 L03A

The primary function of the flap overload valve is to

- A — boost normal system pressure to the flaps in order to overcome the air loads acting on the relatively large flap area.
- B — prevent the flaps from being lowered at air-speeds which would impose excessive structural loads.
- C — cause the flap segments located on opposite sides of the aircraft centerline to extend and retract together so that the aircraft will not become aerodynamically unbalanced to the extent that it becomes uncontrollable.

Answer B. JSAT 8-47, JSTS 5-19
Relief valves are used to control maximum system pressure and to control pressure in various parts of the subsystems. For example, a relief valve, called a wing-flap overload valve, is often placed in the down line of the wing-flap subsystem to prevent lowering of the flaps at too high an air speed.

8C-20 L03A

A unit which transforms hydraulic pressure into linear motion is called

- A — an accumulator.
- B — an actuating cylinder.
- C — a hydraulic pump.

Answer B. JSAT 8-39 (AC65-15A)
An actuating cylinder transforms energy in the form of fluid pressure into mechanical force, or action, to perform work. It is used to impart powered linear motion to some movable object or mechanism.

8C-21 L03A

If it is necessary to adjust several pressure regulating valves in a hydraulic system, what particular sequence, if any, should be followed?

- A — Units are independent of each other, and therefore, no particular sequence is necessary.
- B — Units most distant from the hydraulic pump should be adjusted first.
- C — Units with the highest pressure settings are adjusted first.

Answer C. JSHS 88

When several relief valves are incorporated in a hydraulic system, they should be adjusted in a sequence which will permit each valve to reach its operating pressure. Thus, the highest pressure valves should be adjusted first, the others in the order of descending pressure valves.

8C-22 L03A

Unloading valves are used with many engine driven hydraulic pumps to

- A — dampen out pressure surges.
- B — relieve system pressure.
- C — relieve the pump pressure.

Answer C. JSAT 8-13 (AC65-15A)

Pressure regulator valves in hydraulic systems sometimes serve as unloading valves as well. Pressure regulators maintain the pressure within a specified range and keep the pump unloaded any time no unit is being actuated.

8C-23 L03A

What safety device is usually located between the driving unit and hydraulic pump drive shaft?

- A — Thermal relief valve.
- B — Pump motor safety switch.
- C — Pump drive coupling shear section.

Answer C. JSAT 8-23 (AC43.13-1B AC65-15A)

Pump drive couplings, used with certain hydraulic pumps, are designed to serve as safety devices. If the pump becomes unusually hard to turn, or becomes jammed, the shear section of the drive coupling will break, preventing damage to the pump or the driving unit.

8C-24 L03A

Which valve installed in a hydraulic system will have the highest pressure setting?

- A — Thermal relief valve.
- B — Pressure regulator valve.
- C — Main relief valve.

Answer A. JSAT 8-14

A thermal relief valve is similar to a regular system relief valve, except that it is installed in parts of the system where fluid pressure is trapped and may need to be relieved because of the increase in pressure caused by high temperatures. Thermal relief valves are adjusted to pressures which are above those required for the operation of the systems.

8C-25 L03A

Most variable displacement hydraulic pumps of current design

- A — contain a built in means of system pressure regulation.
- B — must be driven at a nearly constant speed in order to be practical for use.
- C — are not practical for use with a closed center hydraulic system.

Answer A. JSAT 8-25 (AC65-15A)

A variable displacement hydraulic pump has a fluid output that is varied to meet the pressure demands of the system by varying its fluid output. The pump output is changed automatically by a pump compensator which is built into the pump.

8C-26 L03A

In a gear type hydraulic pump, a mechanical safety device incorporated to protect the pump from overload is the

- A — check valve.
- B — shear pin.
- C — bypass valve.

Answer B. JSAT 8-23 (AC43.13-1B AC65-15A)
Gear-type hydraulic pumps, as well as the other types of hydraulic pumps, have a shear pin or shear section incorporated into their drive shafts. If the load on the pump becomes too great, this portion of the shaft will shear to prevent serious damage to the drive unit.

8C-27 L03A

After installation of a rebuilt hydraulic hand pump, it is found that the handle cannot be moved in the pumping direction (pressure stroke). The most likely cause is an incorrectly installed

- A — hand pump output check valve.
- B — hand pump inport check valve.
- C — inport/output orifice check valve.

Answer A. JSAT 8-23

The question here talks about a pressure stroke, so the pump in question is a single-acting hand pump. If the output check valve on such a pump is installed backwards, the pump handle can be moved on the intake stroke, but on the output stroke the backwards check valve will prevent fluid from leaving the pump.

8C-28 L03A

Heat exchanger cooling units are required in some aircraft hydraulic systems because of

- A — fluid flammability.
- B — the high heat generated from braking.
- C — high pressures and high rates of fluid flow.

Answer C. JSHS 19

High pressures and high flow rates will generate heat in the hydraulic system. Many design factors are used to minimize the formation of heat, and heat exchangers may be used to remove heat from the system.

8C-29 L03A

Which is true regarding the ground check of a flap operating mechanism which has just been installed?

- A — If the time required to operate the mechanism increases with successive operations, it indicates the air is being worked out of the system.
- B — If the time required to operate the mechanism decreases with successive operations, it indicates the air is being worked out of the system.
- C — All hydraulic lines and components should be checked for leaks by applying soapy water to all connections.

Answer B. JSHS 87 (AC65-15A)

The design of hydraulic systems is such that they tend to automatically bleed air out of the system when actuators are cycled a few times. If the time it takes for a flap actuator to operate decreases with successive cycles after it is replaced, this is an indication that the air is being worked out of the system.

8C-30 L03A

A hydraulic system operational check during ground run-up of an aircraft indicates that the wing flaps cannot be lowered using the main hydraulic system, but can be lowered by using the emergency hand pump. Which is the most likely cause?

- A — The pressure accumulator is not supplying pressure to the system.
- B — The fluid level in the reservoir is low.
- C — The flap selector valve has a severe internal leak.

Answer B. JSAT 8-14 (AC65-15A)

When an item such as the wing flaps is operated, whether it is by the main system or the emergency system, the majority of the components which are used are the same. The primary separation between the main and the emergency systems is the supply of fluid and the pump. If the flaps operate normally when lowered by the emergency system, but cannot be lowered by the main system, the probable cause is low fluid level in the main system.

8C-31 L03A

Many hydraulic reservoirs contain a small quantity of fluid which is not available to the main system pump. This fluid is retained to

- A — supply fluid to the auxiliary pump.
- B — prime the main system.
- C — supply fluid to the pressure accumulator.

Answer A. JSAT 8-16 (AC65-15A)

Some aircraft have emergency hydraulic systems that take over if main systems fail. In many such systems, the pumps of both systems obtain fluid from a single reservoir. The main system draws its fluid through a standpipe located at a higher level in the reservoir, and the emergency system draws its fluid from the bottom of the reservoir.

8C-32 L03A

The unit which causes one hydraulic operation to follow another in a definite order is called a

- A — selector valve.
- B — shuttle valve.
- C — sequence valve.

Answer C. JSAT 8-31 (AC65-15A)

Sequence valves are used to allow certain operations to occur in a hydraulic system, in a specific order, so that one operation does not interfere with another. They are especially valuable in a landing gear system to control the operation of the gear and gear doors.

8C-33 L03A

The purpose of a hydraulic pressure regulator is to

- A — prevent the system pressure from rising above a predetermined amount due to thermal expansion.
- B — relieve the pump of its load when no actuating units are being operated.
- C — boost the pressure in portions of the system.

Answer B. JSAT 8-35 (AC65-15A)

One of the purposes of a pressure regulator is to maintain system pressure at a predetermined range. The other purpose is to permit the pump to turn without resistance (termed unloading the pump) at times when pressure in the system is within the normal operating range and no units in the system are actuated.

8C-34 L03A

Severe kickback of the emergency hydraulic hand pump handle during the normal intake stroke will indicate which of the following?

- A — The main system relief valve is set too high.
- B — The hand pump inport check valve is sticking open.
- C — The hand pump output check valve is sticking open.

Answer C.

When the hand pump handle is being moved on the intake stroke, the inport check valve is open to allow reservoir fluid to enter the pump. At this time, the output check valve is closed, sealing off the pump from the system pressure. If the output check valve sticks open, the pressure which the system has in it will back up into the hand pump and cause severe kickback.

8C-35 L03A

What type of valve in an aircraft hydraulic system permits fluid to flow freely in one direction, but restricts the rate at which fluid is allowed to flow in the other direction?

- A — Orifice check valve.
- B — Orifice restrictor.
- C — Check valve.

Answer A. JSAT 8-30 (AC65-15A)

The orifice-type in-line check valve is used to allow normal operating speed of a mechanism by providing free flow of fluid in one direction, while allowing limited operating speed through restricted flow of fluid in the opposite direction.

8C-36 L03A

The main system pressure relief valve in a simple hydraulic system equipped with a power control valve should be adjusted

- A — while one or more actuating units are in operation.
- B — with the power control valve held in the CLOSED position.
- C — with the power control valve in the OPEN position.

Answer B. JSAT 8-12

A power control valve, or pump control valve, is a semi-automatic valve which is manually closed and automatically opened. Its purpose is to allow fluid to circulate back to the reservoir to relieve the pump. This valve must be closed before attempting to adjust the main system pressure relief valve, because pressure will not build in the system with it open.

8C-37 L03A

A hydraulic accumulator is charged with an air preload of 1,000 PSI. When a hydraulic system pressure of 3,000 PSI is developed, the pressure on the air side of the accumulator will be

- A — 4,000 PSI.
- B — 3,000 PSI.
- C — 1,000 PSI.

Answer B. JSAT 8-37 (AC65-15A)

The accumulator is a steel sphere divided into two chambers by a synthetic diaphragm. The upper chamber contains system fluid and the lower chamber contains an air pre-charge. Once the hydraulic system is pressurized, the lower pressure is increased by compression until the air pressure equals the system pressure.

8C-38 L03A

How is the air in a hydraulic accumulator prevented from entering the fluid system?

- A — By including a valve that automatically closes when the fluid level lowers to a preset amount.
- B — By physically separating the air chamber from the oil chamber with a flexible or movable separator.
- C — By forcing the oil/air mixture through a centrifugal separating chamber that prevents the air from leaving the accumulator.

Answer B. JSAT 8-36 (AC65-15A)

All accumulators consist of a high-strength container divided by some form of movable partition into two sections, or compartments. One compartment is connected to the hydraulic pressure manifold, and the other compartment is filled with either compressed air or with nitrogen.

8C-39 L03A

After a hydraulic accumulator has been installed and air chamber charged, the main system hydraulic pressure gauge will not show a hydraulic pressure reading until

- A — the fluid side of the accumulator has been charged.
- B — at least one selector valve has been actuated to allow fluid to flow into the fluid side of the accumulator.
- C — the air pressure has become equal to the fluid pressure.

Answer A. JSAT 8-37 (AC65-15A)

Even though a hydraulic accumulator has been charged with air, no system pressure will show on the main system gauge until fluid has been pumped into the fluid side of the accumulator and the accumulator is in a balanced condition.

8C-40 L03A

Which must be done before adjusting the relief valve of a main hydraulic system incorporating a pressure regulator?

- A — Manually unseat all system check valves to allow unrestricted flow in both directions.
- B — Adjust all other system relief valves which have a lower pressure setting.
- C — Eliminate the action of the unloading valve.

Answer C. JSAT 8-12 (AC65-15A)

An unloading valve is a type of pressure regulator. Its purpose is to unload the pump when hydraulic pressure is not required for operation of the system components. Before attempting to adjust a main system relief valve, the unloading valve must be held in a closed position so it won't unload the system.

8C-41 L03A

Some hydraulic systems incorporate a device which is designed to remain open to allow a normal fluid flow in the line, but closed if the fluid flow increases above an established rate. This device is generally referred to as a

- A — hydraulic fuse.
- B — metering check valve.
- C — flow regulator.

Answer A. JSAT 8-33 (AC65-15A)

Modern aircraft depend on their hydraulic systems not only for raising and lowering the landing gear and flaps, but for control system boosts, thrust reversers, brakes, and many auxiliary systems. If a hydraulic leak were to occur in one of these systems, it could potentially drain the entire hydraulic system. To prevent this, the hydraulic fuses are installed which automatically shut off the flow if the volume of fluid passing through the fuse is too great.

8C-42 L03A

When hydraulic system pressure control and relief units fail to function properly, how are most systems protected against overpressure?

- A — A shear section on the main hydraulic pump drive shaft.
- B — One or more hydraulic fuses installed in the pressure and return lines.
- C — A shuttle valve interconnecting the main and emergency systems.

Answer A. JSAT 8-23 (AC43.13-1B, AC65-15A)

If all the other systems designed to prevent overpressure were to fail, the last link in the chain is the shear section on the hydraulic pump. The shear section is designed to fail if the pump becomes too difficult to turn, as it would if the pressure in the system were climbing too high.

8C-43 L03A

A worn hydraulic pump shaft seal can normally be detected by

- A — hydraulic fluid flowing from the pump drain line.
- B — the presence of hydraulic fluid around the pump mounting pad.
- C — evidence of hydraulic fluid combined in the engine oil.

Answer A. JSHS 23 (AC65-15A)

Hydraulic pumps have a drain port located at the bottom of the pump at the shaft end. If the shaft seal is leaking, this will be in evidence by the fluid seen leaking out of the drain port.

8C-44 L03A

If an engine driven hydraulic pump of the correct capacity fails to maintain normal system pressure during the operation of a cowl flap actuating unit, the probable cause is

- A — restriction in the pump outlet.
- B — a partial restriction in the inport of the selector valve.
- C — mechanical interference to the movement of the cowl flap.

Answer A. (AC65-15A)

If a hydraulic pump is of the correct capacity, it should be able to maintain normal pressure during the operation of a cowl flap actuator, as well as any other actuator in the system. In a typical hydraulic system, the pressure gage is just downstream of the accumulator, and upstream of all the hydraulic actuators and selector valves. A problem with the cowl flap or the selector valve would not affect the system pressure because they are downstream of the pressure gage and pressure relief valve.

8C-45 L03A

Before removing the filler cap of a pressurized hydraulic reservoir,

- A — relieve the hydraulic system pressure.
- B — relieve the air pressure.
- C — actuate several components in the system.

Answer B. JSAT 8-19 (AC65-15A)

Hydraulic reservoirs are either vented to the atmosphere or closed to the atmosphere and pressurized. If a reservoir is pressurized, the pressure must be released before removing the cap.

8C-46 L03A

What happens to the output of a constant displacement hydraulic pump when the hydraulic system pressure regulator diverts the fluid from the system to the reservoir?

- A — The output pressure and volume remain the same.
- B — The output pressure reduces, but the volume remains the same.
- C — The output pressure remains the same, but the volume reduces.

Answer B. JSAT 8-23 (AC65-15A)

A constant displacement pump is one that puts out a fixed volume of fluid per revolution of the pump. Because the system cannot always use the full volume of displaced fluid, there is a pressure regulator in the system which diverts fluid back to the reservoir. This diverting of fluid back to the reservoir happens when a set pressure has been reached. At this time, the pressure in the system is reduced, but the volume output of the pump remains the same.

8C-47 L03A

Hydraulic system accumulators serve which of the following functions?

1. Dampen pressure surges.
2. Supplement the system pump when demand is beyond the pump's capacity.
3. Store power for limited operation of components if the pump is not operating.
4. Ensure a continuous supply of fluid to the pump.

A — 1, 2, and 3.

B — 2 and 3.

C — 1, 2, 3, and 4.

Answer A. (AC65-15A)

An accumulator in a hydraulic system is a device used to store hydraulic fluid under pressure. It dampens pressure surges and aids or supplements the pump when the demand is beyond the pump's capacity. It also stores power for limited operation of components when the pump is not operating.

8C-48 L03A

Chattering of the hydraulic pump during operation is an indication

- A — that air is entering the pump.
- B — of low accumulator preload.
- C — that the main system relief valve is sticking open.

Answer A. (AC43.13-1B AC65-15A)

Hydraulic pressure pumps are designed to move liquids, not air. If an air leak exists at the inlet to a hydraulic pump, the pump will draw the air in because it offers the least resistance to flow. If the leak is a small one, the pump will draw a mixture of liquid and air, and will be partially cavitating. The partial cavitating of the pump will be heard as a chattering sound.

8C-49 L03A

A hydraulic pump is a constant-displacement type if it

- A — produces an unregulated constant pressure.
- B — produces a continuous positive pressure.
- C — delivers a uniform rate of fluid flow.

Answer C. JSAT 8-23 (AC65-15A)

A constant displacement pump, regardless of pump RPM, forces a fixed quantity of fluid through the outlet port during each revolution of the pump.

8C-50 L03A

A hydraulic motor converts fluid pressure to

- A — linear motion.
- B — rotary motion.
- C — angular motion.

Answer B. JSAT 8-41

A hydraulic motor is, in essence, a hydraulic pump with the flow of fluid reversed. Instead of rotary motion producing pressure fluid flow as it does in a pump, with the hydraulic motor pressure fluid flow produces rotary motion.

8C-51 L03A

Hydraulic fluid filtering elements constructed of porous paper are normally

- A — discarded at regular intervals and replaced with new filtering elements.
- B — not approved for use in certificated aircraft.
- C — cleaned and reused.

Answer A. JSAT 8-20 (AC65-15A)

Micronic type filters used in hydraulic systems are made of a specially treated paper. This type of filter should be replaced periodically, according to the applicable instructions, rather than being cleaned.

8C-52 L03A

A pilot reports that when the hydraulic pump is running, the pressure is normal. However, when the pump is stopped, no hydraulic pressure is available. This is an indication of a

- A — leaking selector valve.
- B — low accumulator fluid preload.
- C — leaking accumulator air valve.

Answer C. JSAT 8-37 (AC65-15A)

In a hydraulic system which is shut down (pump not turning), there will only be pressure showing on the gage if the accumulator has a preload. If the accumulator has a leaking valve, the preload in the air side of the accumulator will be completely lost. Although the pressure in the system when the pump is running might be normal, the operation of the system with an accumulator which has lost its preload will not be normal.

8C-53 L03A

If fluid is added to a reservoir in a constant pressure hydraulic system while the system is pressurized. What will result?

- A — Fluid will spray violently out of the reservoir when the filler neck cap is removed.
- B — The fluid level will increase when system pressure is reduced.
- C — Air will be drawn into the system, when the filler neck cap is removed.

Answer B. JSAT 8-16 (AC65-15A)

In a hydraulic system which uses a nonpressurized reservoir, the cap on the reservoir can be removed while the system is pressurized. This is not the time, however, to service the reservoir; the fluid which it takes to pressurize the system is out of the tank at this time. When the pressure in the system is reduced, fluid will return to the tank and increase its level, possibly to the point of being over serviced.

8C-54 L03A

In a hydraulic system that has a reservoir pressurized with turbine engine compressor bleed air, which unit reduces the air pressure between the engine and reservoir?

- A — Air bleed relief valve.
- B — Relief valve.
- C — Air pressure regulator.

Answer C. JSAT 8-18 (AC65-15A)

Pressurizing a reservoir with air is accomplished by forcing air into the reservoir above the level of the fluid. In most cases, the initial source of the air pressure is the aircraft engine from which it is bled. Usually, air coming directly from the engine is at a pressure of approximately 100 PSI. This pressure is reduced to between 5 and 15 PSI, depending on the type of hydraulic system, by using an air pressure regulator.

8C-55 L03A

What is the main purpose of a pressurized reservoir in a hydraulic system?

- A — Prevent hydraulic pump cavitation.
- B — Prevent hydraulic fluid from foaming.
- C — Prevent tank collapse at altitude.

Answer A. JSAT 8-16 (AC65-15A)

Air pressure and gravity are the forces that cause fluid to flow from the reservoir into the pump intake. Reservoirs for hydraulic systems used in aircraft that fly at high altitudes are normally pressurized to produce a positive supply of fluid to the engine-driven pump. This prevents pump cavitation.

8C-56 L03A

Hydraulic fluid reservoirs are sometimes designed with a standpipe in one of the outlet ports in order to assure emergency supply of fluid. The outlet port with the standpipe in it furnishes fluid to the

- A — emergency pump when the fluid supply to the normal system has been depleted.
- B — emergency pump at any time it is required.
- C — normal system power pump.

Answer C. JSAT 8-14 (AC65-15A)

When the normal supply of fluid and the emergency supply of fluid are coming from the same hydraulic reservoir, the reservoir is fitted with a standpipe. The standpipe extends above the bottom of the reservoir, and it supplies fluid to the normal system power pump. The emergency system draws its fluid from the bottom of the reservoir.

8C-57 L03A

An emergency supply of fluid is often retained in the main hydraulic system reservoir by the use of a standpipe. The supply line is connected to the

- A — inlet of the emergency pump.
- B — inlet of the main system pump.
- C — inlet of the main hydraulic system.

Answer B. JSAT 8-14 (AC65-15A)

When hydraulic reservoirs contain a standpipe, the standpipe supplies fluid to the main system pump. The emergency system draws its fluid from the bottom of the reservoir.

8C-58 L03A

To check the air charge in a hydraulic accumulator,

- A — read it directly from the auxiliary pressure gauge.
- B — reduce all hydraulic pressure, then observe the reading on the accumulator air gauge.
- C — observe the first reading on the hydraulic system gauge while operating a component in the system.

Answer B. JSAT 8-37

The air charge in the accumulator may be determined by reducing all hydraulic pressure and observe the reading on the accumulator air gage. If the aircraft is not so equipped, the system pressure gage may be used to check the air charge in the accumulator. The procedures for using the system pressure gage will vary with the system, and manufacturer's procedures must be followed.

8C-59 L03A

How would the air pressure charge in the accumulator be determined if the engine is inoperative, but the system still has hydraulic pressure?

- A — Operate a hydraulic unit slowly and note the pressure at which a rapid pressure drop begins as it goes toward zero.
- B — Read it directly from the main system pressure gauge with all actuators inoperative.
- C — Build up system pressure with the emergency pump and then read the pressure on a gauge attached to the air side of the accumulator.

Answer A. JSAT 8-37

The air charge in the accumulator may be determined by reducing all hydraulic pressure and observe the reading on the accumulator air gage. If the aircraft is not so equipped, the system pressure gage may be used to check the air charge in the accumulator. The procedures for using the system pressure gage will vary with the system, and manufacturer's procedures must be followed.

8C-60 L03A

Chatter in a hydraulic system is caused by

- A — excessive system pressure.
- B — air in the system.
- C — insufficient system pressure.

Answer B. JSHS 87

The most likely cause of chatter in a hydraulic system is trapped air. Hydraulic systems are designed to handle liquids, not gases. When a hydraulic system has air in it, it causes erratic operation of the system components. This erratic operation is evidenced by a chattering sound.

8C-61 L03A

If hydraulic fluid is released when the air valve core of the accumulator is depressed, it is evidence of

- A — a leaking check valve.
- B — a ruptured diaphragm or leaking seals.
- C — excessive accumulator air pressure.

Answer B. JSAT 8-37

If hydraulic fluid is found in the air chamber of an accumulator, there is a leak between the two chambers. In such cases, the accumulator must be removed and repaired.

8C-62 L03A

If the hydraulic system pressure is normal while the engine driven pump is running, but there is no pressure after the engine has been shut off, it indicates

- A — no air pressure in the accumulator.
- B — the system relief valve setting is too high.
- C — the pressure regulator is set too high.

Answer A. JSAT 8-37 (AC65-15A)

In a hydraulic system which is shut down (pump not turning), there will only be pressure showing on the gage if the accumulator has a preload. Although the pressure in the system when the pump is running might be normal, the operation of the system with an accumulator which has lost its preload will not be normal.

8C-63 L03A

The purpose of restrictors in hydraulic systems is to

- A — allow the flow of fluid in one direction only.
- B — control the rate of movement of hydraulically operated mechanisms.
- C — lower the operating pressure of selected components.

Answer B. JSAT 8-30 (AC65-15A)

Restrictors in a hydraulic system control the rate of movement of hydraulically operated mechanisms. They control the rate of movement by restricting the flow of fluid into and out of the mechanism.

8C-64 L03A

A loud hammering noise in a hydraulic system having an accumulator usually indicates

- A — too low or no preload in the accumulator.
- B — too much preload in the accumulator.
- C — air in the fluid.

Answer A. JSHS 87 (AC65-15A)

A loud hammering noise in a system having an accumulator indicates an insufficient air preload in the accumulator.

8C-65 R02A

In most modern hydraulically actuated landing gear systems, the order of gear and fairing door operation is controlled by

- A — sequence valves.
- B — microswitches.
- C — shuttle valves.

Answer A. JSAT 8-31 (AC65-15A)

When the landing gear of an airplane is being retracted or lowered, sequence valves are used to control the order of events.

8C-66 L03A

The hydraulic component that automatically directs fluid from either the normal source or an emergency source to an actuating cylinder is called a

- A — bypass valve.
- B — crossflow valve.
- C — shuttle valve.

Answer C. JSAT 8-55

Quite frequently in hydraulic systems it is necessary to provide alternate or emergency sources of power with which to operate critical parts of the system. In such a case, there must be a means of disconnecting the normal source of hydraulic power and connecting the emergency source of power. This is the function of a shuttle valve.

SECTION D

AIRCRAFT PNEUMATIC SYSTEMS

Section D of Chapter 8 includes information regarding pneumatic system components, maintenance, and pneumatic system designs.

8D-1 L01A

What function does the absolute pressure regulator perform in the pneumatic power system?

- A — Regulates the compressor outlet air pressure to stabilize the system pressure.
- B — Regulates the compressor inlet air to provide a stabilized source of air for the compressor.
- C — Regulates the pneumatic system pressure to protect the moisture separator from internal explosion.

Answer B. (AC65-15A)

The compressor inlet air for a pneumatic system is filtered through a high temperature, 10 micron filter and the air pressure is regulated by an absolute pressure regulator to provide a stabilized source of air for the compressor.

8D-2 L01A

Relief valves are used in pneumatic systems

- A — as damage preventing units.
- B — for one direction flow control.
- C — to reduce the rate of airflow.

Answer A. JSAT 8-58 (AC65-15A)

Relief valves are used in pneumatic systems to prevent damage. They act as pressure-limiting units and prevent excessive pressures from bursting lines and blowing out seals.

8D-3 L01A

An aircraft pneumatic system, which incorporates an engine driven multistage reciprocating compressor, also requires

- A — a surge chamber.
- B — an oil separator.
- C — a moisture separator.

Answer C. JSAT 8-54 (AC65-15A)

Moisture in a compressed air system will condense and freeze when the pressure of the air is dropped for actuation and, for this reason, every bit of water must be removed from the air. A moisture separator collects the water that is in the air on a baffle and holds it until the system is shut down. The separator will remove approximately 98% of the water in the air.

8D-4 L01A

Pneumatic systems utilize

- A — return lines.
- B — relief valves.
- C — diluter valves.

Answer B. JSAT 8-53 (AC65-15A)

Of the three items mentioned in this question, the only one that pneumatic systems utilize is a relief valve.

8D-5 L03A

The air that is expended and no longer needed when an actuating unit is operated in a pneumatic system is

- A — returned to the compressor.
- B — exhausted or dumped, usually overboard.
- C — charged or pressurized for use during the next operating cycle.

Answer B. JSAT 8-51

Pneumatic systems simply exhaust air overboard after it has done the required work.

8D-6 L03A

In a typical high pressure pneumatic system, if the moisture separator does not vent accumulated water when the compressor shuts down, a likely cause is a

- A — malfunctioning pressure transmitter.
- B — malfunctioning solenoid dump valve.
- C — saturated chemical dryer.

Answer B. JSAT 8-54 (AC65-15A)

The condensation dump valve solenoid is energized and de-energized by the pressure switch. When energized, it prevents the compressor from dumping air overboard; when de-energized, it completely purges the separator's reservoir and lines up to the air compressor.

AIRCRAFT LANDING GEAR SYSTEMS

SECTION A LANDING GEAR SYSTEMS AND MAINTENANCE

Section A of Chapter 9 contains information regarding retractable and fixed landing gear designs, components, and maintenance practices.

9A-1 K01A

To prevent a very rapid extension of an oleo shock strut after initial compression resulting from landing impact,

- A — various types of valves or orifices are used which restrict the reverse fluid flow.
- B — the air is forced through a restricted orifice in the reverse direction.
- C — the metering pin gradually reduces the size of the orifice as the shock strut extends.

Answer A. JSAT 9-5, JSHS 60 (AC65-15A)
Some shock struts are equipped with a damping or snubbing device consisting of a recoil valve on the piston or recoil tube, to reduce the rebound during the extension stroke, and to prevent too rapid an extension of the shock strut.

9A-2 K01A

The metering pins in oleo shock struts serve to

- A — retard the flow of oil as the struts are compressed.
- B — meter the proper amount of air in the struts.
- C — lock the struts in the DOWN position.

Answer A. JSAT 9-5 (AC65-15A)
Most shock struts employ a metering pin for controlling the rate of fluid flow from the lower chamber into the upper chamber. During the compression stroke, the rate of fluid flow is not constant, but is controlled automatically by the variable shape of the metering pin as it passes through the orifice.

9A-3 K01A

After performing maintenance on an aircraft's landing gear system which may have affected the system's operation, it is usually necessary to

- A — make an operational check with the aircraft on jacks.
- B — re-inspect the area after the first flight.
- C — conduct a flight test.

Answer A. JSAT 9-17 (AC65-15A AC43.13-1B)
After working on the gear retraction system of an aircraft in such a way that the proper operation of the system could be affected, it is absolutely essential that a retraction test be performed on the gear. One can rest assured that the aircraft maintenance manual will require a retraction test in such an instance.

9A-4 K01A

The fusible plugs installed in some aircraft wheels will

- A — melt at a specified elevated temperature.
- B — prevent over inflation.
- C — indicate tire tread separation.

Answer A. JSAT 9-6 (AC65-15A)
The fusible plug in an aircraft wheel is designed to melt and let the air escape from the tire if the temperature gets too high. This is done so the tire will not blow out because of the excessive temperature.

9A-5 K01A

Over inflated aircraft tires may cause damage to the

- A — wheel flange.
- B — brake linings.
- C — wheel hub.

Answer A. JSAT 9-9
The most difficult area of an aircraft wheel to inspect is the bead seat region on the wheel flange. This area, which is highly stressed by the inflated tire, can be distorted or cracked by a hard landing or a seriously over-inflated tire.

9A-6 K01A

The repair for an out of tolerance toe-in condition of main landing gear wheels determined not to be the result of bent or twisted components consists of

- A — shimming the axle in the oleo trunnion.
- B — placing shims or spacers behind the bearing of the out of tolerance wheel or wheels.
- C — inserting, removing, or changing the location of washers or spacers at the center pivotal point of the scissor torque links.

Answer C. JSAT 9-13 (AC65-15A)
Toe-in is adjusted on landing gear using an oleo-type shock absorber by adding or removing washers from between the torque links.

9A-7 K01A

An embossed letter "H" on an air valve core stem

- A — indicates high-pressure type.
- B — indicates hydraulic type.
- C — is the manufacturer's trademark.

Answer A. JSAT 8-38
A raised "H" on the stem of an air valve core stands for high pressure. This type of air valve core is used on shock struts or accumulators, not tires.

9A-8 K01A

On all aircraft equipped with retractable landing gear, some means must be provided to

- A — extend the landing gear if the normal operating mechanism fails.
- B — retract and extend the landing gear if the normal operating mechanism fails.
- C — prevent the throttle from being reduced below a safe power setting while the landing gear is retracted.

Answer A. JSAT 9-14
All retractable landing gear systems must have some means of lowering the gear in the event the main extension system should fail. Most emergency systems employ either mechanical, pressure-bottle or free-fall extension capabilities.

9A-9 K01A

An automatic damping action occurs at the steering damper if for any reason the flow of high pressure fluid is removed from the

- A — outlet of the steer damper.
- B — replenishing check valve.
- C — inlet of the steer damper.

Answer C. JSAT 9-12 (AC65-15A)

The steering damper accomplishes two separate functions; one is steering the nose wheel and the other is shimmy damping. The steer damper automatically reverts to damping when, for any reason, the flow of high-pressure fluid is removed from the inlet of the steer damper.

9A-10 K01A

What is the purpose of the torque links attached to the cylinder and piston of a landing gear oleo strut?

- A — Limit compression stroke.
- B — Maintain correct wheel alignment.
- C — Hold the strut in place.

Answer B. JSAT 9-12 (AC65-15A)

Torque links keep the landing gear pointed in a straight ahead direction; one torque link connects to the shock strut cylinder, while the other connects to the piston.

9A-11 K01A

When an air/oil type of landing gear shock strut is used, the initial shock of landing is cushioned by

- A — compression of the fluid.
- B — the fluid being forced through a metered opening.
- C — compression of the air charge.

Answer B. JSAT 9-5 (AC65-15A)

Most shock struts employ a metering pin for controlling the rate of fluid flow from the lower chamber of the strut into the upper chamber. During the compression stroke, the rate of fluid flow is not constant, but is controlled by the variable shape of the metering pin as it passes through the orifice.

9A-12 K01A

A sleeve, spacer, or bumper ring is incorporated in a landing gear oleo shock strut to

- A — limit the extension stroke.
- B — limit the extension of the torque arm.
- C — reduce the rebound effect.

Answer A. JSAT 9-5, JSHS 60 (AC65-15A)

The extension stroke of an oleo shock strut occurs at the end of the compression stroke, as the energy stored in the compressed air causes the aircraft to start moving upward in relation to the ground and wheels. A snubbing device is used to prevent the strut from rebounding too rapidly, and a sleeve, spacer, or bumper ring is incorporated to limit the extension stroke of the strut.

9A-13 K01A

The purpose of a sequence valve in a hydraulic retractable landing gear system is to

- A — prevent heavy landing gear from falling too rapidly upon extension.
- B — provide a means of disconnecting the normal source of hydraulic power and connecting the emergency source of power.
- C — ensure operation of the landing gear and gear doors in the proper order.

Answer C. JSAT 9-16 (AC65-15A)

In a retractable landing gear system, sequence valves are used to ensure that the landing gear doors open and close at the proper time.

9A-14 K01A

When servicing an air/oil shock strut with MIL-5606 the strut should be

- A — collapsed and fluid added at the filler opening.
- B — partially extended and fluid added at the filler opening.
- C — fully extended and fluid added at the filler opening.

Answer A. JSAT 9-5 (AC65-15A)

When servicing an air/oil shock, it should be fully collapsed and fluid added to the specifications of the manufacturer.

9A-15 K01A

Instructions concerning the type of fluid and amount of air pressure to be put in a shock strut are found

- A — in the aircraft manufacturer's service manual.
- B — in the aircraft operations limitations.
- C — on the airplane data plate.

Answer A. JSAT 9-5 (AC65-15A)
Proper methods of servicing shock struts with fluid and nitrogen will be found in aircraft manufacturers service manuals.

9A-16 K01A

If the extended longitudinal axis of the main landing gear wheel assemblies intersects aft of the aircraft, the wheels can be termed as having

- A — negative camber.
- B — toe-out.
- C — toe-in.

Answer B. JSAT 9-12
Toe-in or toe-out is the amount the wheels deviate from a straight ahead condition. If the front of the wheels try to move together, they are toed in. If the front of the wheels try to move apart, they are toed out. A toed out condition will cause the longitudinal axis of the wheels, if extended, to meet somewhere behind the aircraft.

9A-17 K01A

If an aircraft shock strut (air/oil type) bottoms upon initial landing contact, but functions correctly during taxi, the most probable cause is

- A — a restricted metering pin orifice.
- B — low air charge.
- C — low fluid.

Answer C. JSAT 9-5
The air/oil shock strut absorbs the landing impact by letting oil transfer from the oil chamber into the air chamber around a tapered metering pin. Taxi shocks are taken up by the compressed air in the upper chamber. Bottoming out on landing is caused by low fluid level.

9A-18 K01A

What is the function of a cam incorporated in a nose gear shock strut?

- A — Provides steering of aircraft during ground operation.
- B — Straightens the nosewheel.
- C — Provides an internal shimmy damper.

Answer B. JSAT 9-17 (AC65-15A)
Centering devices include such units as internal centering cams to center the nose wheel as it retracts into the wheel well.

9A-19 K01A

Extension of an oleo shock strut is measured to determine the

- A — physical condition of the strut itself.
- B — amount of oil in the strut.
- C — proper operating position of the strut.

Answer C. JSAT 9-5 (AC65-15A)
On some shock struts the correct amount of inflation is determined by measuring the amount of extension (in inches) between two given points on the strut.

9A-20 K01A

What should be checked when a shock strut bottoms during a landing?

- A — Fluid level.
- B — Air pressure.
- C — Packing seals for correct installation.

Answer A. JSAT 9-5
The most likely cause of a shock strut bottoming on landing is low fluid level.

9A-21 K01A

The hydraulic packing seals used in a landing gear shock strut are

- A — generally designed to be compatible with more than one type of fluid.
- B — used only with a specific type of fluid.
- C — kept from direct contact with fluid by teflon or nylon backup rings.

Answer B. JSAT 8-7

Due to the difference in composition vegetable base, petroleum base and phosphate ester base fluids will not mix. Neither are the type of seals for any one fluid usable with, or tolerant of, any of the other fluids.

9A-22 K01A

When an empty shock strut is filled with fluid, care should be taken to extend and compress the strut completely at least two times to

- A — ensure proper packing ring seating and removal of air bubbles.
- B — force out any excess fluid.
- C — thoroughly lubricate the piston rod.

Answer A. JSAT 9-6 (AC65-15A)

After an empty shock strut is serviced, it must be bled to get the air out of the fluid cavity. This is done by extending and compressing the strut until there is no sign of air bubbles coming from the strut bleed nose. This same operation also ensures the proper seating of the seals in the strut.

9A-23 K01A

In shock struts, chevron seals are used to

- A — serve as a bearing surface.
- B — prevent oil from escaping.
- C — absorb bottoming effect.

Answer B. JSAT 8-42

Chevron seals in shock struts are used to seal the oil in the strut. They are located between the inner and outer cylinders at the lower end of the shock strut. They are held in place between packing spacers, which compress the chevron seals and force them to form a tight seal.

9A-24 K01A

On most aircraft, the oil level of an air and oil shock strut is checked by

- A — releasing the air and seeing that the oil is to the level of the filler plug.
- B — measuring the length of the strut extension with a certain air pressure in the strut.
- C — removing the oil filler plug and inserting a gauge.

Answer A. JSAT 9-5 (AC65-15A)

When servicing a shock strut, the air pressure should be released and the strut fully compressed. The strut should then be filled to the level of the air valve opening with an approved type of hydraulic fluid.

9A-25 K01A

A landing gear position and warning system will provide a warning in the cockpit when the throttle is

- A — advanced and gear is down and locked.
- B — retarded and gear is down and locked.
- C — retarded and gear is not down and locked.

Answer C. JSAT 9-17 (AC65-15A)

Gear warning devices are incorporated on all retractable gear aircraft, and usually consist of a horn or some other aural device, and a red warning light. The horn blows and the light comes on when one or more throttles are retarded and the landing gear is in any position other than down and locked.

9A-26 K01A

When installing a chevron type seal in an aircraft hydraulic cylinder, the open side of the seal should face

- A — the direction of fluid pressure.
- B — up or forward when the unit is installed in a horizontal position.
- C — opposite the direction of fluid pressure.

Answer A. JSAT 8-42 (AC65-9A)

When a chevron seal is installed, it must have its open end facing the direction from which the pressure is applied. This causes the seal to open up and exert outward pressure against the surface it is trying to seal.

9A-27 K01A

Nose gear centering cams are used in many retractable landing gear systems. The primary purpose of the centering device is to

- A — engage the nosewheel steering.
- B — center the nosewheel before it enters the wheel well.
- C — align the nosewheel prior to touchdown.

Answer B. JSAT 9-17 (AC65-15A)
Centering devices include such units as internal centering cams to center the nose wheel as it retracts into the wheel well.

9A-28 K01A

A special bolt in a landing gear attachment requires a torque value of 440 inch-pounds. How many foot-pounds are required?

- A — 36.6
- B — 38
- C — 36.8

Answer A. JSGT 9-28 (AC43.13-1B)
Because there are 12 inches in a foot, there are 12 inch-pounds in one foot-pound. To convert inch-pounds to foot-pounds, divide the inch-pounds by 12. In this case, 440 divided by 12 equals 36.6 ft.-lbs.

9A-29 K01A

(Refer to Airframe figure 10) The trunnion nut on an aircraft landing gear requires a torque of 320 inch-pounds. To reach the nut, a 2-inch straight adapter must be used on an 18-inch torque wrench. How many foot-pounds will be indicated on the torque wrench when the required torque of the nut is reached?

- A — 24
- B — 22
- C — 28.8

Answer A. JSGT 9-29
Adapter length can be figured by using the formula below. Inch-pounds must be converted to foot-pounds. TA (Actual torque) = $TW(L+A) \div L$; TW (Torque read on torque wrench) = $TA \times L \div (L+A)$; $TW = 320 \times 18 \div (18+2)$; $TW = 288$ in-lbs $288 \div 12 = 24$ ft-lbs

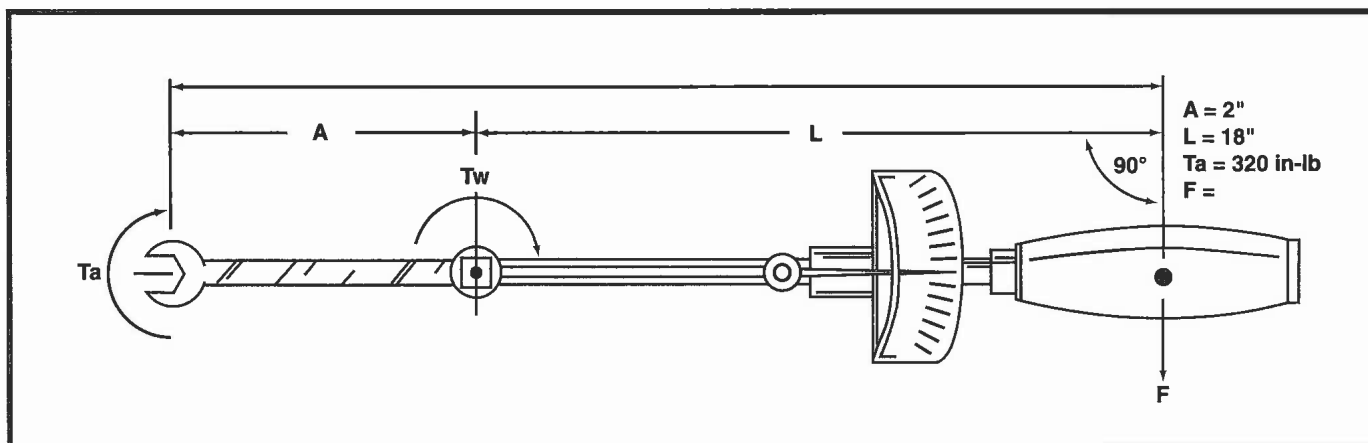


Figure 10. — Torque Value

9A-30 R02A

Which repair would require a landing gear retraction test?

- A — Red warning light bulb.
- B — Landing gear safety switch.
- C — Gear downlock microswitch.

Answer C. JSAT 9-17

Of the choices given in this question, the only repair that would need a retraction test to check out is the gear downlock microswitch. If the microswitch is repaired or replaced, its adjustment will need to be checked. Since this is the microswitch which turns on the green light in the cockpit to identify the gear as being down and locked, it is essential that its adjustment be correct.

9A-31 K01A

If a shock strut bottoms after it has been properly serviced, the

- A — air pressure should be increased.
- B — strut should be disassembled and the metering pin orifice plate replaced.
- C — strut should be removed, disassembled, and inspected.

Answer C. (AC65-15A)

A properly serviced shock strut should not bottom unless it is subjected to an excessive force during a hard landing. If a strut does bottom during normal operation, something is wrong inside the strut, and it must be taken apart and inspected. Increasing air pressure or fluid level is definitely not the answer.

9A-32 K01A

Why do tire and wheel manufacturers often recommend that the tires on split rim wheels be deflated before removing the wheel from the axle?

- A — To relieve the strain on the wheel retaining nut and axle threads.
- B — As a safety precaution in case the bolts that hold the wheel halves together have been damaged or weakened.
- C — To remove the static load imposed upon the wheel bearings by the inflated tire.

Answer B. JSAT 9-7 (AC65-15A)

A maintenance technician should always be sure to deflate tires completely before demounting. It is also recommended that tires be deflated before wheels are removed from the aircraft. With split rim wheels, there is always a possibility of the rim separating when the tire is under pressure.

SECTION B AIRCRAFT BRAKES

Section B of Chapter 9 contains information regarding aircraft braking system designs, components, and maintenance practices.

9B-1 K01A

What would be the effect if the piston return spring broke in a brake master cylinder?

- A — The brake travel would become excessive.
- B — The brakes would become spongy.
- C — The brakes would drag.

Answer C. JSAT 9-26 (AC65-15A)

When the brake pedal is released, the master cylinder piston is returned to the OFF position by a return spring. If the spring were broken, the piston would not return and some pressure could stay in the system. This would cause the brakes to drag.

9B-2 K01A

In brake service work, the term “bleeding brakes” is the process of

- A — replacing small amounts of fluid in reservoir.
- B — withdrawing air only from the system.
- C — withdrawing fluid from the system for the purpose of removing air that has entered the system.

Answer C. JSAT 9-31 (AC65-15A)

Bleeding brakes is for the purpose of getting air out of the system which could cause spongy and ineffective brakes. Bleeding is accomplished by forcing fluid out of the system under pressure, which takes the air out of the system at the same time.

9B-3 K01A

A pilot reports the right brake on an aircraft is spongy when the brake pedal is depressed in a normal manner. The probable cause is

- A — the hydraulic master cylinder piston return spring is weak.
- B — air in the brake hydraulic system.
- C — the hydraulic master cylinder piston is sticking.

Answer B. JSAT 9-31

The most likely cause of spongy brake action is air in the system. If air is found, it must be removed in order to restore proper braking action.

9B-4 K01A

Aside from an external leak in the line, what will cause parking brakes to creep continually to the OFF position?

- A — Insufficient hydraulic fluid in the reservoir.
- B — Glazed brake linings.
- C — An internal leak in the master cylinder

Answer C. JSAT 9-26 (AC65-15A)

A common type of parking brake is one that operates by depressing the brake pedals and pulling a parking brake handle, which locks the brakes in a depressed position with a ratchet mechanism. If the master cylinder piston has a faulty seal and allows fluid to pass by it, the brakes will release even though the pedals are still held depressed.

9B-5 K01A

If it is determined that spongy brake action is not caused by air in the brake system, what is the next most likely cause?

- A — Deteriorated flexible hoses.
- B — Internal leakage in the master cylinder.
- C — Worn brake lining.

Answer A. JSAT 9-31, JSHS 87 (AC65-15A)
Although the most likely cause of spongy brakes is air in the system, another good candidate is a flexible brake line which is deteriorated. This deteriorated brake line will flex and expand when pressure is applied, acting just like air being compressed in a brake system.

9B-6 K01A

Many brake types can be adapted to operate mechanically or hydraulically. Which type is not adaptable to mechanical operation?

- A — Expander tube type.
- B — Single disk spot type.
- C — Single servo type.

Answer A. JSAT 9-24 (AC65-15A)
The expander tube type of brake uses a tube made of neoprene reinforced with fabric, which fluid enters under pressure to expand the brakes and apply a stopping force. This system needs fluid pressure to operate.

9B-7 K01A

A brake deboster valve is installed in systems where the high pressure of the hydraulic system (3,000 PSI) is used to operate brakes

- A — that are used on aircraft having high landing speeds.
- B — that are designed to work with lower pressure.
- C — that are used in conjunction with an antiskid system.

Answer B. JSAT 9-28 (AC65-15A)
Brakes normally operate with pressures of considerably less than 3,000 PSI. A brake deboster valve is installed between the anti-skid valve and the wheel cylinder to lower the hydraulic system pressure.

9B-8 K01A

When bleeding aircraft brakes, one of the indications that the air has been purged from the system is

- A — full brake pedal travel.
- B — partial brake pedal travel.
- C — firm brake pedals.

Answer C. JSAT 9-31, 9-32
Bleeding of brakes should continue until no more air bubbles come through the bleeder hose into the container. Once all air has been removed from the system, the brake pedals should be firm (not spongy).

9B-9 K01A

Debooster valves are used in brake systems primarily to

- A — reduce the pressure and release the brakes rapidly.
- B — reduce brake pressure and maintain static pressure.
- C — ensure rapid application and release of the brakes.

Answer A. JSAT 9-28 (AC65-15A)

Debooster units are generally used on aircraft equipped with a high pressure hydraulic system and low pressure brakes. Brake deboster cylinders reduce the pressure to the brakes and increase the volume of fluid flow. When the brake pedals are released, the deboster causes a suction in the line to the brake assembly, resulting in faster release of the brakes.

9B-10 K01A

Power boost brake systems are used on aircraft that have

- A — high landing speeds.
- B — low normal hydraulic system pressure.
- C — more than one brake assembly per axle.

Answer C. JSAT 9-27 (AC65-15A)

Power boost brakes are used on aircraft that require more braking force than can be applied with an independent master cylinder, but do not require the complex power brake system.

9B-11 K01A

The removal, installation, and repair of landing gear tires by the holder of a private pilot certificate on an aircraft the pilot owns or operates is considered to be

- A — a violation of the Federal Aviation Regulations.
- B — preventive maintenance.
- C — a minor repair.

Answer B. (FAR 43, Appendix A)
According to FAR 43, pilots are allowed to remove, install, and repair landing gear tires on aircraft owned and operated by them.

9B-12 K01A

Aircraft brakes requiring a large volume of fluid to operate the brakes generally

- A — use power brake control valves.
- B — do not use brake system accumulators.
- C — use independent master cylinder systems.

Answer A. JSAT 9-27 (AC65-15A)

Power brake control valve systems are used on aircraft requiring a large volume of fluid to operate the brakes. Because larger aircraft require larger brakes with greater fluid displacement and pressures, an independent master cylinder system is not practical.

9B-13 K01A

What is one effect a restricted compensator port of a master cylinder will have on a brake system?

- A — The reservoir will be filled by reverse flow.
- B — The restriction will cause slow release of the brakes.
- C — The brakes will operate normally.

Answer B. JSAT 9-26 (AC65-15A)

The typical master cylinder has a compensating port or valve that permits fluid to flow from the brake chamber back to the reservoir when excessive pressure is developed in the brake line due to temperature changes. If this port is blocked, the brakes will be slow to release.

9B-14 K01A

Internal leakage in a brake master cylinder unit can cause

- A — the pedal to slowly creep down while pedal pressure is applied.
- B — fading brakes.
- C — slow release of brakes.

Answer A. JSAT 9-26 (AC65-15A)

Internal leakage in a master cylinder indicates that fluid is bypassing the piston seal rather than being forced into the fluid lines under pressure. If this occurs, the line pressure slowly drops allowing the brake pedal to creep to the floor.

9B-15 K01A

The pressure source for power brakes is

- A — the main hydraulic system.
- B — a master cylinder.
- C — the power brake reservoir.

Answer A. JSAT 9-27 (AC65-15A)

In a power brake system, a line is tapped off from the main hydraulic system pressure line. A check valve is installed in this line to prevent loss of brake system pressure in case of main system failure.

9B-16 K01A

Which statement is true with respect to an aircraft equipped with hydraulically operated multiple disk type brake assemblies?

- A — There are no minimum or maximum disk clearance checks required due to the use of self compensating cylinder assemblies.
- B — No parking brake provisions are possible for this type of brake assembly.
- C — Do not set parking brake when brakes are hot.

Answer C. JSAT 9-24 (AC65-15A)

If the parking brake is set when the brakes are hot, there is a chance the brake disks will warp. This is caused by the disks not being able to dissipate heat when clamped tightly together. This is not as serious a problem as it once was because of the higher quality alloys in use today, and because the disks are thicker than they used to be.

9B-17 K01A

The purpose of a relief valve in a brake system is to

- A — prevent the tire from skidding.
- B — reduce pressure for brake application.
- C — compensate for thermal expansion.

Answer C. (AC65-15A)

The purpose of a relief valve or compensator port in a power brake system is to bypass fluid into the return line, if the pressure in the system gets too high. If the temperature of the brake fluid in a power brake system were to get too high, the relief valve would unseat due to the thermal expansion of the fluid.

9B-18 K01A

What is the purpose of a compensating port or valve in a brake master cylinder of an independent brake system?

- A — Permits the fluid to flow toward or away from the reservoir as temperature changes.
- B — Prevents fluid from flowing back to the reservoir.
- C — Assists in the master cylinder piston return.

Answer A. JSAT 9-26 (AC65-15A)

The typical master cylinder has a compensating port or valve that permits fluid to flow from the brake chamber back to the reservoir when excessive pressure is developed in the brake line, due to temperature changes. During normal operation, the valve allows reservoir fluid to fill the master cylinder when the brakes are released.

9B-19 K01A

Debooster cylinders are used in brake systems primarily to

- A — reduce the pressure to the brake and increase the volume of fluid flow.
- B — relieve excessive fluid and ensure a positive release.
- C — reduce brake pressure and maintain static pressure.

Answer A. JSAT 9-28 (AC65-15A)

In some power brake control valve systems, deboster cylinders are used in conjunction with the power brake control valves. Brake boosters reduce the pressure to the brake and increase the volume of fluid flow.

9B-20 K01A

If an airplane equipped with master cylinders and single disk brakes has excessive brake pedal travel, but the brakes are hard and effective, the probable cause is

- A — the master cylinder one way cup is leaking.
- B — worn brake linings.
- C — worn brake disk causing excessive clearance between the notches on the perimeter of the disk and the splines or keys on the wheel.

Answer B. JSAT 9-22 (AC65-15A)

Of the answers provided with this question, the only one that is remotely correct is the worn brake linings. A leakage in the master cylinder could cause the excessive pedal travel, but not if the brakes are hard and effective. A worn brake disk could cause the problem if it were worn on the faces, but the distracter identifies wear on the perimeter of the disk. Single-disk brakes will typically have an adjusting pin that keeps the clearance between the brake linings and the disk constant, so the pedal travel will not change as the linings wear. If this feature were not present, worn brake linings would cause increased pedal travel.

9B-21 K01A

How can it be determined that all air has been purged from a master cylinder brake system?

- A — By noting whether the brake is firm or spongy.
- B — By noting the amount of fluid return to the master cylinder upon brake release.
- C — By operating a hydraulic unit and watching the system pressure gauge for smooth, full scale deflection.

Answer A. JSAT 9-31 (AC65-15A)

A sure sign of air in a brake system which uses an independent master cylinder is spongy brakes. A good firm brake pedal is a good sign that all the air has been purged from the system.

9B-22 K01A

The left brake is dragging excessively on an airplane on which no recent brake service work has been performed. The most probable cause is

- A — excessively worn brake linings.
- B — low fluid supply in the brake system reservoir.
- C — foreign particles stuck in the master cylinder compensating port.

Answer C. JSAT 9-38 (AC65-15A)

The compensating port in a master cylinder allows fluid to flow back to the reservoir when the brakes are released. If the compensating port is blocked, pressure will be held on the system when the brakes are released and they will drag.

9B-23 K01A

If a brake debooster is used in a hydraulic brake system, its position in the system will be

- A — in the brake pressure line between the brake pedal and the brake accumulator.
- B — between the brake control valve and the brake actuating cylinder.
- C — between the pressure manifold of the main hydraulic system and the power brake control valve.

Answer B. JSAT 9-28 (AC65-15A)

A typical mounting location for a debooster cylinder would be on the landing gear shock strut, in line between the brake control valve and the brake actuating cylinder.

9B-24 K01A

Lockout deboosters are primarily pressure reducing valves that

- A — cannot allow full deboost piston travel without fluid from the high pressure side entering the low pressure chamber.
- B — allow full deboost piston travel without fluid from the high pressure side entering the low pressure chamber.
- C — must be bled separately after brake bleeding has been completed.

Answer B. JSAT 9-29

Lockout deboosters employ a spring-loaded valve to prevent fluid from entering the lower chamber until the reset handle is lifted.

9B-25 K01A

A pilot reports that the brake pedals have excessive travel. A probable cause is

- A — brake lining has oil or some foreign matter on the disks and linings.
- B — brake rotors have worn.
- C — lack of fluid in the brake system.

Answer B.

Automatic adjusters compensate for disk wear each time the brakes are applied. In the event of automatic adjuster malfunction, as the disk wears, pedal travel will increase.

9B-26 K01A

What type of valve is used in the brake actuating line to isolate the emergency brake system from the normal power brake control valve system?

- A — A shuttle valve.
- B — A bypass valve.
- C — An orifice check valve.

Answer A. JSAT 8-55 (AC65-15A)

Each brake actuating line in a power brake system incorporates a shuttle valve for the purpose of isolating the emergency brake system from the normal brake system.

9B-27 K01A

The braking action of a Cleveland disk brake is accomplished by compressing a rotating brake disk between two opposite brake linings. How is equal pressure on both sides of the rotating disk assured?

- A — By allowing the brake rotor to float to automatically equalize as pressure is applied to the rotor.
- B — By allowing the brake linings to automatically equalize as pressure is applied to the rotor.
- C — By allowing the caliper to float to automatically equalize as pressure is applied to the rotor.

Answer C. JSAT 9-20 (AC65-15A)

In a Cleveland Brake System, when the pedal is pushed, hydraulic pressure from the brake control unit enters the brake cylinders and forces the pistons and their pucks against the rotating disk. The caliper is free to move laterally on two mounting bolts.

SECTION C

AIRCRAFT TIRES AND TUBES

Section C of Chapter 9 includes information regarding aircraft tire and tube designs, identification, and maintenance practices.

9C-1 K01A

Why do most aircraft tire manufacturers recommend that the tubes in newly installed tires be first inflated, fully deflated, and then reinflated to the correct pressure?

- A — To eliminate all the air between the tube and the inside of the tire.
- B — To allow the tube to position itself correctly inside the tire.
- C — To test the entire assembly for leaks.

Answer B. JSAT 9-50 (AC65-15A)

When inflating a tire in which a new tube has just been installed, put the tire in a safety cage and gradually bring the air pressure up to the recommended value to seat the beads and then deflate the tire. Then reinflate the tire to the correct pressure. This inflation, deflation, and re-inflation procedure allows the tube to straighten itself out inside the tire.

9C-2 K01A

A stripe or mark applied to a wheel rim and extending onto the sidewall of a tube type tire is a

- A — wheel weight reference mark.
- B — wheel-to-tire balance mark.
- C — slippage mark.

Answer C. JSAT 9-51 (AC43.13-1B, AC65-15A)

A stripe or mark that extends from the rim of the wheel onto the tire is used to detect slippage of the tire on the rim. Slippage can occur if the tire is under-inflated, or if it is subjected to severe stress when landing or braking.

9C-3 K01A

The primary purpose for balancing aircraft wheel assemblies is to

- A — prevent heavy spots and reduce vibration.
- B — reduce excessive wear and turbulence.
- C — distribute the aircraft weight properly.

Answer A. JSAT 9-51 (AC65-15A)

Balance in an aircraft wheel assembly is very important. From a wear standpoint, when the wheels are in landing position, a heavy spot in a wheel assembly will have a tendency to remain at the bottom and thus will always strike the ground or runway first. This results in severe wear at one area of the tire tread. In addition, unbalanced tires can cause severe vibration.

9C-4 K01A

Aircraft tire pressure should be checked

- A — using only a push on stick-type gauge having 1-pound increments.
- B — at least once a week or more often.
- C — as soon as possible after each flight.

Answer B. JSAT 9-43 (AC65-15A)

Proper inflation is undoubtedly the most necessary maintenance function for safe, long service from aircraft tires. Many experts recommend checking tire pressure daily and before each flight.

9C-5 K01A

A high speed aircraft tire with a sound cord body and bead may be recapped

- A — a maximum of three times.
- B — only by the tire manufacturer.
- C — an indefinite number of times.

Answer C. JSAT 9-47

The wide variation in tire operating environments which may affect total carcass life and serviceability makes it inadvisable to prescribe arbitrarily the maximum number of times a high speed tire should be retreaded. This aspect, therefore, is controlled by thorough inspection of the carcass before retreading.

9C-6 K01A

The correct inflation pressure for an aircraft tire can be obtained from

- A — the information stamped on the aircraft wheel.
- B — the aircraft service manual.
- C — tire manufacturer's specifications.

Answer B. JSAT 9-43 (AC65-15A)

The proper inflation pressure is that specified by the aircraft manufacturer in his service manuals or operator's manuals. Even for the same tire, this pressure will vary from one aircraft to another.

9C-7 K01A

When a properly operating fusible plug has allowed a tire to deflate, the tire should be

- A — externally inspected for damage.
- B — removed from the wheel and inspected for carcass and tread damage.
- C — replaced.

Answer C. JSAT 9-46

If the tire has been exposed to enough heat to melt the fusible plug, it should be replaced. This excessive heat will cause damage to the tire that may not be obvious.

9C-8 K01A

Chines are used on some aircraft nose wheel tires to

- A — help deflect water away from the fuselage.
- B — help reduce the possibility of hydroplaning.
- C — help nose gear extension at higher air speeds.

Answer A. JSAT 9-42 (AC65-15A)

Chines are used on some nose wheel tires to deflect water away from fuselage mounted engines.

9C-9 K01A

The best safeguards against heat buildup in aircraft tires are

- A — proper tire inflation, minimum braking, and ground rolls into the wind.
- B — minimum braking, proper tire inflation, and long ground rolls.
- C — short ground rolls, slow taxi speeds, minimum braking, and proper tire inflation.

Answer C. JSAT 9-43 (AC65-15A)

Tires are as vital to the operation of aircraft as they are to the operation of an automobile. During ground operation, tires can be considered as ground control surfaces. The same rules of safe driving and careful inspection apply on the runways as on the highway. These rules include control of speed, braking, cornering, inspection for proper inflation, checking for cuts and bruises, and signs of tread wear. The toughest demand on tires is the heat buildup during lengthy ground operations.

9C-10 K01A

What action, if any, should be taken when there is a difference of more than 5 pounds of air pressure in tires mounted as duals?

- A — Replace the tire with the lowest pressure.
- B — Replace both tires.
- C — Correct the discrepancy and enter in logbook.

Answer C. JSAT 9-43 (AC65-15A)

Differences of air pressure in tires mounted as duals, whether main or nose, should be cause for concern, as it ordinarily means that one tire is carrying more of the load than the other. If there is a difference it should be corrected and noted in the aircraft log. Aircraft service manuals should be checked for exact specifications.

9C-11 K01A

How long should you wait after a flight before checking tire pressure?

- A — At least 3 hours (4 hours in hot weather).
- B — At least 2 hours (3 hours in hot weather).
- C — At least 4 hours (5 hours in hot weather).

Answer B. JSAT 9-44 (AC65-15A)
Wait at least two hours after a flight before checking pressures (three hours in hot weather).

9C-12 K01A

Excessive wear in the shoulder area of an aircraft tire is an indication of

- A — excessive toe in.
- B — underinflation.
- C — over inflation.

Answer B. JSAT 9-43 (AC65-15A)
Under-inflation results in harmful and potentially dangerous effects. One of the problems it can cause is rapid or uneven wear at or near the edge of the tread.

9C-13 K01A

Excessive wear in the center of the tread of an aircraft tire is an indication of

- A — over inflation.
- B — excessive toe out.
- C — incorrect camber.

Answer A. JSAT 9-43 (AC65-15A)
If the center ribs are worn away while the shoulder ribs still have an appreciable depth, the tire has been operated in an over-inflated condition.

CHAPTER

10

POSITION AND WARNING SYSTEMS

SECTION A ANTISKID BRAKE CONTROL SYSTEMS

This section contains information regarding anti-skid system operating theory, components, and maintenance practices.

10A-1 R01A

The purpose of antiskid generators is to

- A — measure wheel rotational speed and any speed changes.
- B — monitor hydraulic pressure applied to brakes.
- C — indicate when a tire skid occurs.

Answer A. JSAT 10-3 (AC65-15A)

Antiskid generators measure the rotational speed of the wheel and any changes in the rotational speed. A signal is generated that varies in frequency or signal strength according to the speed of the wheel.

10A-2 R01A

In a brake antiskid system, when an approaching skid is sensed, an electrical signal is sent to the skid control valve which

- A — relieves the hydraulic pressure on the brake.
- B — acts as a bypass for the deboosters cylinders.
- C — equalizes the hydraulic pressure in adjacent brakes.

Answer A. JSAT 10-4 (AC65-15A)

In an antiskid brake system, the skid control valves are located downstream of the brake control valves. When the skid control generator senses a change in wheel speed, it sends a signal to the skid control box, which in turn sends a signal to the skid control valve. The skid control valve takes the brake system pressure supplied to it and bypasses some of it back to the system return line. The amount of pressure the skid control valve allows to go to the brakes should not allow a wheel skid to occur.

10A-3 R01A

An antiskid system is

- A — a hydraulic system.
- B — an electrical system.
- C — an electrohydraulic system.

Answer C. JSAT 10-2 (AC65-15A)

An antiskid system makes use of electrical components, such as the skid control generator and the skid control box, as well as hydraulic components, such as the skid control valves. This combination of electrical and hydraulic components makes the antiskid an electrohydraulic system.

10A-4 R01A

Antiskid braking systems are generally armed by

- A — the rotation of the wheels above a certain speed.
- B — a centrifugal switch.
- C — a switch in the cockpit.

Answer C. JSAT 10-6 (AC65-15A)

The pilot can turn off the operation of the antiskid system by a switch in the cockpit.

10A-5 R01A

- (1) When an airplane is slowed below approximately 20 MPH, the antiskid system automatically deactivates to give the pilot full control of the brakes for maneuvering and parking.
- (2) An antiskid system consists basically of three components; wheel speed sensors, control box, and control valves. Regarding the above statements,

A — only No. 1 is true.
 B — both No. 1 and No. 2 are true.
 C — only No. 2 is true.

Answer B. JSAT 10-3

At speeds below approximately 20 MPH, the antiskid system automatically gives the pilot full control of the brakes for maneuvering and parking. The antiskid system consists basically of three components: the wheel speed sensors, the control box, and the control valves.

10A-6 R01A

In an antiskid system, wheel skid is detected by

- A — a sudden rise in brake pressure.
 B — a discriminator.
 C — an electrical sensor.

Answer C. JSAT 10-3

In an antiskid system the wheel skid is detected by an electrical sensor of either an AC or DC type.

10A-7 R01A

Which of the following functions does a skid control system perform?

1. Normal skid control.
2. Normal braking.
3. Fail safe protection.
4. Locked wheel skid control.
5. Touchdown protection.
6. Takeoff protection.

A — 1, 2, 5, and 6.
 B — 1, 3, 4, and 5.
 C — 1, 2, 3, and 4.

Answer B. JSAT 10-4 (AC65-15A)

The skid control system performs four functions: normal skid control, locked wheel skid control, touchdown protection and fail safe protection.

10A-8 R01A

In the air with the antiskid armed, current cannot flow to the antiskid control box because

- A — landing gear squat switch is open.
 B — landing gear down and lock switch is open.
 C — landing gear antiskid valves are open.

Answer A. JSAT 10-5 (AC65-15A)

The antiskid does not become energized until the airplane touches down, the squat switch registers that the weight is on the wheels, and 20 MPH is registered by the wheel rotation sensors.

10A-9 R01A

At what point in the landing operation does normal skid control perform its function?

- A — When wheel rotation deceleration indicates an impending skid.
 B — Anytime the wheel is rotating.
 C — When wheel rotation indicates hydroplaning

Answer A. JSAT 10-6 (AC65-15A)

Normal skid control comes into play when wheel rotation slows down but has not come to a stop.

10A-10 R01A

- (1) An antiskid system is designed to apply enough force to operate just below the skid point.
- (2) A warning lamp lights in the cockpit when the antiskid system is turned off or if there is a system failure. Regarding the above statements,

A — only No. 1 is true.
 B — both No. 1 and No. 2 are true.
 C — only No. 2 is true.

Answer B. JSAT 10-3 (AC65-15A)

The antiskid system is designed to apply enough force to operate the wheel's speed just below the skid point because this gives the most effective braking. A warning lamp lights when the system is turned off or if there is a system failure.

10A-11 R02A

When a landing gear safety switch on a main gear strut closes at liftoff, which system is deactivated?

- A — Antiskid system.
- B — Aural warning system.
- C — Landing gear position system.

Answer A. JSAT 10-5 (AC65-15A)

When an airplane takes off and the ground safety switch closes, it completes the circuit for the retraction of the gear. Depending on the airplane, it may also deactivate the antiskid system. What this actually does is deactivate the brakes so they cannot be locked up at touchdown.

SECTION B INDICATING AND WARNING SYSTEMS

Section B of Chapter 10 contains information regarding stall, angle-of-attack, and takeoff warning systems. It also includes landing gear position indicating and warning systems, as well as selsyn, Autosyn®, and Magnesyn® position indicating systems.

10B-1 N01A

The operation of an angle of attack indicating system is based on detection of differential pressure at a point where the air stream flows in a direction

- A — parallel to the longitudinal axis of the aircraft.
- B — parallel to the angle of attack of the aircraft.
- C — not parallel to the true angle of attack of the aircraft.

Answer C. JSAT 10-10 (AC65-15A)

The operation of the angle-of-attack indicating system is based on detection of differential pressure at a point where the airstreams is flowing in a direction that is not parallel to the true angle of attack of the aircraft. This differential pressure is caused by changes in airflow around the probe unit.

10B-2 R01A

A typical takeoff warning indication system, in addition to throttle setting, monitors the position of which of the following?

- A — Ailerons, elevators, speed brake, and steerable
- B — fuselage landing gear.
- C — Elevators, speed brake, flaps, and stabilizer trim.

Answer C. JSAT 10-12

Takeoff Warning Systems will monitor the takeoff position of critical control surfaces and systems. These include stabilizer trim, trailing edge flap, leading edge device, and speedbrake positions.

10B-3 R01A

The primary purpose of a takeoff warning system is to alert the crew that a monitored flight control is not properly set prior to takeoff. The system is activated by

- A — a thrust lever.
- B — an 80 knot airspeed sensor.
- C — an ignition system switch not set for takeoff.

Answer A. JSAT 10-12 (AC65-15A)

The takeoff configuration warning system is armed when the aircraft is on the ground and one or more thrust levers are advanced to the takeoff position.

10B-4 R01A

The angle of attack detector operates from differential pressure when the air stream

- A — is parallel to the longitudinal axis of the aircraft.
- B — is not parallel to the true angle of attack of the aircraft.
- C — is parallel to the angle of attack of the aircraft.

Answer B. JSAT 10-10 (AC65-15A)

The operation of the angle-of-attack indicating system is based on detection of differential pressure at a point where the air stream is flowing in a direction that is not parallel to the true angle of attack of the aircraft.

10B-5 R01A

When an airplane's primary flight control surfaces are set for a particular phase of flight, such as landing or takeoff, the corresponding control-surface indicating system will show

- A — speed brake position.
- B — flap/slat position.
- C — trim position.

Answer B. JSAT 10-12

When an aircraft is configured for a particular phase of flight, the various primary control surfaces have an associated position. The flap/slat positions will be indicated on their respective indicators, and the position will be relayed to the computer for determination that it is set correctly.

10B-6 R01A

The pneumatic (reed) type stall warning system installed in some light aircraft is activated by

- A — positive air pressure.
- B — static air pressure.
- C — negative air pressure.

Answer C. JSAT 10-9

As the angle of attack increases, the low pressure air traveling over the wing moves into the area where the reed inlet is located, causing it to sound.

10B-7 R01A

Stall warning systems are generally designed to begin warning the pilot when a stall

- A — is starting to occur.
- B — first affects the outboard portions of the wings.
- C — is imminent.

Answer C. JSAT 10-9

The stall warning system tells the pilot that the aircraft is reaching an angle of attack that is approaching a stall.

10B-8 R02A

Which of the following conditions is most likely to cause the landing gear warning signal to sound?

- A — Landing gear locked down and throttle retarded.
- B — Landing gear not locked down and throttle retarded.
- C — Landing gear locked down and throttle advanced.

Answer B. JSAT 10-12 (AC65-15A)

Aircraft with retractable landing gear use an aural warning system to alert the crew of an unsafe condition. A horn sounds if the throttle is retarded and the landing gear is not in a down and locked condition.

10B-9 R02A

Where is the landing gear safety switch usually located?

- A — On the pilot's control pedestal.
- B — On the main gear shock strut.
- C — On the landing gear drag brace.

Answer B. JSAT 9-16 (AC65-15A)

Landing gear safety switches are usually located on the main gear shock struts.

10B-10 R02A

What safety device is actuated by the compression and extension of a landing gear strut?

- A — Downlock switch.
- B — Ground safety switch.
- C — Uplock switch.

Answer B. JSAT 9-16 (AC65-15A)

Airplanes that have retractable landing gear usually have a ground safety switch attached to one or more of their gear struts. When the airplane is on the ground and the gear struts are compressed, the ground safety switch breaks the circuit that would allow the gear to retract. When the airplane takes off and the gear struts extend, the switch completes the circuit and the gear is allowed to retract.

10B-11 R02A

Landing gear warning systems usually provide which of the following indications?

- A — Green light for gear up and down, red light for unsafe gear.
- B — Red light for unsafe gear, green light for gear down, no light for gear up.
- C — Red light for unsafe gear, no light for gear down, green light for gear up.

Answer B. JSAT 10-12 (AC65-15A)

Most gear warning systems provide a red light for an unsafe gear, a green light for the gear down, and no indication for gear up.

10B-12 R02A

What landing gear warning device(s) is/are incorporated on retractable landing gear aircraft?

- A — A light which comes on when the gear is fully down and locked.
- B — A horn or other aural device and a red warning light.
- C — A visual indicator showing gear position.

Answer B. JSAT 9-17 (FAR 23 AC65-15A)

An airplane which has retractable landing gear is required to have an aural and a visual warning system to let the pilot know if the gear is not down and locked.

10B-13 R02A

The rotor in an autosyn remote indicating system uses

- A — neither an electromagnet nor a permanent magnet.
- B — an electromagnet.
- C — a permanent magnet.

Answer B. JSAT 10-11

In an Autosyn® indicating system the rotor is an electromagnet.

10B-14 R02A

The basic difference between an autosyn and a magnesyn indicating system is the

- A — rotor.
- B — transmitter.
- C — receiver.

Answer A. JSAT 10-11

The Autosyn® system uses an electromagnet for its rotor while the Magnesyn® system utilizes a permanent magnet.

10B-15 R02A

The rotor in a magnesyn remote indicating system uses

- A — an electromagnet.
- B — an electromagnet and a permanent magnet.
- C — a permanent magnet.

Answer C. JSAT 10-12 (AC65-15A)

The Magnesyn® system utilizes a permanent magnet as the rotor in both the sender and the receiver.

10B-16 R02A

Which of the following are some uses for a DC selsyn system?

1. Indicates position of retractable landing gear.
2. Indicates the angle of incidence of an aircraft.
3. Indicates the altitude of an aircraft.
4. Indicates cowl flaps or oil cooler door position.
5. Indicates fuel quantity.
6. Indicates the rate of climb of an aircraft.
7. Indicates position of wing flaps.

A — 2, 3, 5, and 6.

B — 2, 3, 4, and 5.

C — 1, 4, 5, and 7.

Answer C. JSAT 10-11 (AC65-15A)

The DC Selsyn® system can be used to indicate position of retractable landing gear, cowl flaps, oil cooler doors, or wing flaps, as well as fuel quantity with some types of fuel quantity gages.

10B-17 R02A

- (1) A DC selsyn system is a widely used electrical method of indicating a remote mechanical movement or position.
- (2) A synchro type indicating system is an electrical system used for transmitting information from one point to another.

Regarding the above statements,

A — both No. 1 and No. 2 are true.

B — only No. 2 is true.

C — only No. 1 is true.

Answer A. JSAT 10-11 (AC65-15A)

A synchro system is an electrical system used for transmitting information from one point to another. The DC selsyn system is a widely used electrical method of indicating a remote mechanical condition.

10B-19 R02A

(Refer to Airframe figure 19) Which repair should be made if the gear switch was placed in UP position and the gear does not retract?

- A — Replace electrical wire No. 15.
- B — Replace the down limit switch.
- C — Replace electrical wire No. 12.

Answer C. JSAT 10-12

When the gear switch is placed in the UP position, power will be supplied from the 20 amp breaker, through the switch to the relay. In order for power to flow through the relay to the gear motor, the relay must be activated. A break in wire No. 12 would prevent the relay from closing.

10B-20 R02A

(Refer to Airframe figure 20) What will illuminate the amber indicator light?

- A — Closing the nosewheel gear full retract switch.
- B — Retarding one throttle and closing the left wheel gear locked down switch.
- C — Closing the nose, left and right wheel gear full retract switches.

Answer C. JSAT 10-12

The amber indicator light is in the "gear full retracted indicator system" part of the circuit. The light is illuminated when all three gear are in the full retracted position. The light obtains its ground through the gear full retract switches.

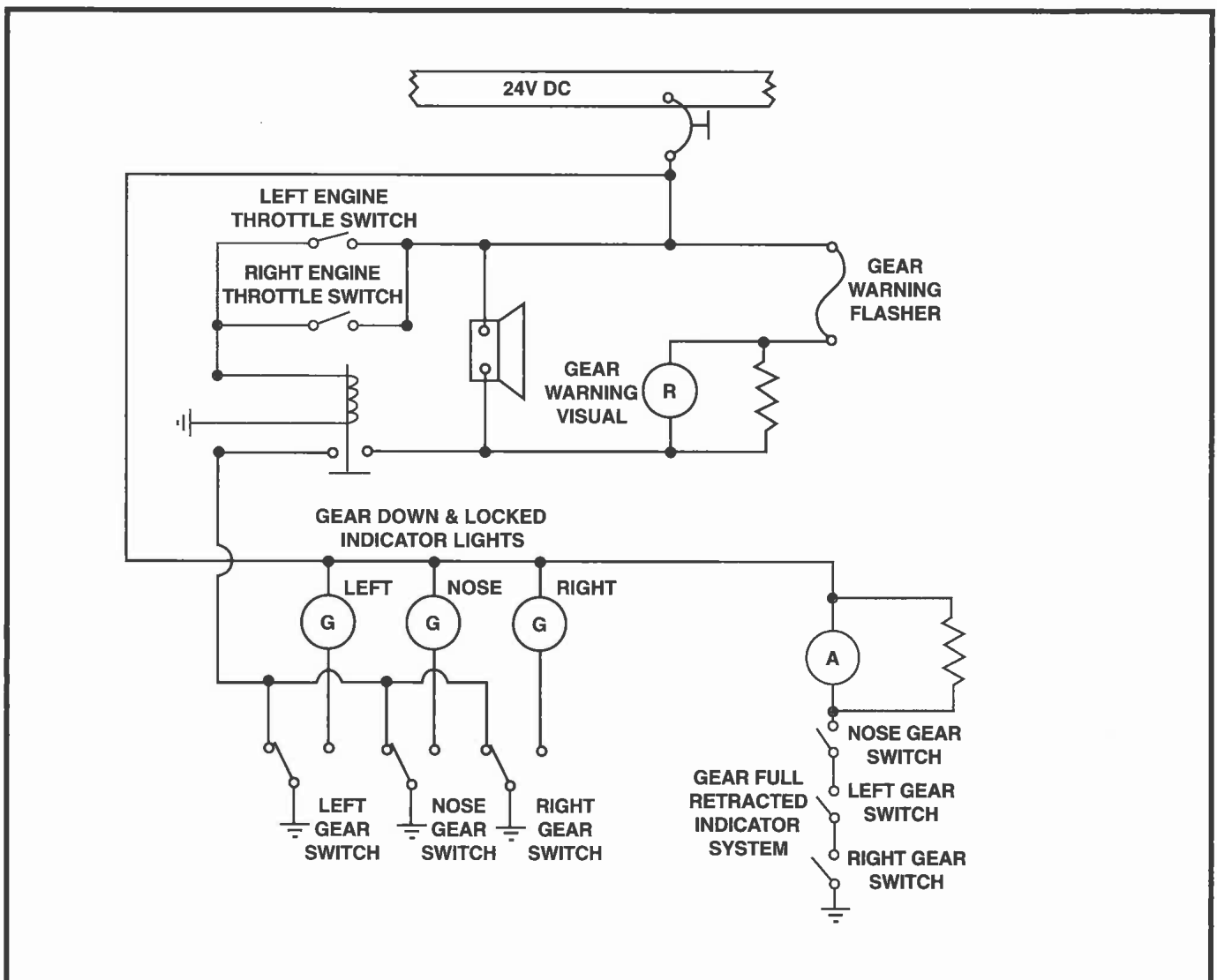


Figure 20. Landing Gear Circuit

10B-21 R02A

(Refer to Airframe figure 20) What is the minimum circumstance that will cause the landing gear warning horn to indicate an unsafe condition?

- A — Any gear not down and locked, and one throttle retarded.
- B — All gears up and one throttle retarded.
- C — Any gear up and both throttles retarded.

Answer A. JSAT 10-12 (AC65-15A)

Although the horn sounds in all the configurations listed, the minimum circumstance required is any gear not down and locked and one throttle retarded.

AIRCRAFT INSTRUMENT SYSTEMS

SECTION A PRINCIPLES OF INSTRUMENT SYSTEMS

Section A of Chapter 11 contains information regarding principles of flight and engine instruments and instrument system operating principles.

11A-1 N02A

Which instruments are connected to an aircraft's static pressure system only?

1. Vertical speed indicator.
2. Cabin altimeter.
3. Altimeter.
4. Cabin rate-of-change indicator.
5. Airspeed indicator.

- A — 2 and 4.
B — 1 and 3.
C — 2, 4, and 5.

Answer B. JSAT 11-31

The airspeed indicator is connected to both the pitot and static systems, and cabin instruments are not connected to outside references.

11A-2 N01A

The operating mechanism of most hydraulic pressure gauges is

- A — a Bourdon tube.
B — an evacuated bellows filled with an inert gas to which suitable arms, levers, and gears are attached.
C — an airtight diaphragm.

Answer A. JSAT 11-5 (AC65-15A)

A hydraulic pressure gage generally uses a Bourdon tube and a gear-and-pinion mechanism by which the Bourdon tube's motion is amplified and transferred to the pointer.

11A-3 N01A

What is the fixed line mark attached to the compass bowl of a magnetic compass called?

- A — Reference line.
B — Lubber line.
C — Reeder line.

Answer B. JSAT 11-23 (AC65-15A)

The fixed reference marker attached to the compass bowl of a magnetic compass is called a lubber line.

11A-4 R01A

- (1) An airspeed indicator measures the differential between pitot and static air pressures surrounding the aircraft at any moment of flight.
- (2) An airspeed indicator measures the differential between pitot and cabin air pressures at any moment of flight. Regarding the above statements,

- A — both No. 1 and No. 2 are true.
B — only No. 2 is true.
C — only No. 1 is true.

Answer C. JSAT 11-5 (AC65-15A)

Airspeed indicators are sensitive instruments which measure the difference between the pitot and static pressures.

11A-5 N01A

When swinging a magnetic compass, the compensators are adjusted to correct for

- A — magnetic variations.
- B — compass card oscillations.
- C — magnetic influence deviation.

Answer C. JSAT 11-24 (AC65-15A)

A compensating device containing small permanent magnets is incorporated in the compass to correct for deviations of the compass which result from the magnetic influences of the aircraft structure and electrical system.

11A-6 N01A

What will be the result if the instrument static pressure line becomes disconnected inside a pressurized cabin during cruising flight?

- A — The altimeter will read low and the airspeed indicator will read high.
- B — The altimeter and airspeed indicator will both read low.
- C — The altimeter and airspeed indicator will both read high.

Answer B. JSAT 11-32 (AC65-15A)

An aircraft's altimeter and airspeed indicator rely on the static pressure reading to accurately indicate their readings. The altimeter displays altitude as a function of outside (ambient) pressure, a reading which comes from the static system. The airspeed indicator displays a reading by comparing the total pressure in the pitot system to the static pressure reading. If the static pressure value being supplied to both of these systems is coming from a pressurized cabin, it will cause the altimeter and the airspeed indicator to both read low.

11A-7 N01A

Magnetic compass bowls are filled with a liquid to

- A — dampen the oscillation of the float.
- B — reduce deviation errors.
- C — retard precession of the float.

Answer A. JSAT 11-22 (AC65-15A)

The magnetic compass consists of a liquid filled bowl containing a pivoted float element to which one or more bar magnets, called needles, are fastened. The liquid in the bowl dampens the oscillations of the float and decreases the friction of the pivot.

11A-8 N01A

Which statement regarding an aircraft instrument vacuum system is true?

- A — If the air inlet to each vacuum instrument is connected to a common atmospheric pressure manifold, the system generally will be equipped with individual instrument filters only.
- B — Vacuum systems are generally more effective at high altitudes than positive pressure systems.
- C — Dry type vacuum pumps with carbon vanes are very susceptible to damage from solid airborne particles and must take in only filtered air.

Answer C. JSAT 11-28

Because a dry air pump operates with the carbon vanes providing both the seal and the lubrication, cleanliness is very important. Any solid particles drawn into the pump can damage the carbon vanes and lead to destruction of the pump. To prevent this type of damage the air inlet is covered with a filter.

11A-9 N01A

When an aircraft altimeter is set at 29.92 inches Hg on the ground, the altimeter will read

- A — field elevation.
- B — density altitude.
- C — pressure altitude.

Answer C. JSAT 11-7 (AC65-9A)

When an altimeter is set at 29.92 in. Hg on the ground, it reads pressure altitude.

11A-10 N01A

A barometric altimeter indicates pressure altitude when the barometric scale is set at

- A — field elevation.
- B — 14.7 inches Hg.
- C — 29.92 inches Hg.

Answer C. JSAT 11-7 (AC65-9A)

When an altimeter's barometric scale is set at 29.92 in. Hg, the altimeter indicates the pressure altitude.

11A-11 N01A

A Bourdon tube instrument may be used to indicate

1. pressure.
2. temperature.
3. position.

A — 1.
B — 2 and 3.
C — 1 and 2.

Answer C. JSAT 11-5, JSAT 11-14 (AC65-15A)
If an indicator needle is attached to the free end of a Bourdon tube, its reactions to changes in fluid pressure can be observed. Changes in pressure can be caused by changes in temperature.

11A-12 N01A

A turn coordinator instrument indicates

- A — both roll and yaw.
B — the need for corrections in pitch and bank.
C — the longitudinal attitude of the aircraft during climb and descent.

Answer A. JSAT 11-21 (AC65-15A)
The turn coordinator senses roll and yaw because of its canted gyro.

11A-13 N01A

Thermocouple leads

- A — are designed for a specific installation and may not be altered.
B — may be repaired using solderless connectors.
C — may be installed with either lead to either post of the indicator.

Answer A. JSAT 11-15 (AC65-15A)
Thermocouple leads are designed to provide a definite amount of resistance in the thermocouple circuit. Thus, their length or cross-sectional size cannot be altered unless some compensation is made for the change in total resistance. A typical turbine engine thermocouple system, for example, operates with 8 ohms of resistance.

11A-14 N01A

Turbine engine exhaust gas temperatures are measured by using

- A — iron/constantan thermocouples.
B — chromel/alumel thermocouples.
C — ratiometer electrical resistance thermometers.

Answer B. JSAT 11-15 (AC65-15A)
The thermocouples used in a turbine engine are made from chromel (a nickel/chromium alloy) and alumel (a nickel/aluminum alloy).

11A-15 N01A

Fuel flow transmitters are designed to transmit data

- A — mechanically.
B — utilizing fluid power.
C — electrically.

Answer C. JSAT 11-35 (AC65-15A)
Fuel flow transmitters send an electrical signal to the indicator in the cockpit through wires.

11A-16 N01A

What does a reciprocating engine manifold pressure gauge indicate when the engine is not operating?

- A — Zero pressure.
B — The differential between the manifold pressure and the atmospheric pressure.
C — The existing atmospheric pressure.

Answer C. JSAT 11-6 (AC65-15A)
When an aircraft engine is not running, its manifold pressure gage should read the existing atmospheric pressure.

11A-17 N02A

Cases for electrically operated instruments are made of

- A — Iron or steel cases.
- B — Plastic or composite cases.
- C — Aluminum or bakelite cases.

Answer A. JSAT 11-45 (AC65-15A)

Cases for electrically operated instruments are made of iron or steel because these materials provide a path for stray magnetic force fields that would otherwise interfere with radio and electronic devices.

11A-18 N01A

Which condition would be most likely to cause excessive vacuum in a vacuum system?

- A — Vacuum relief valve improperly adjusted.
- B — Vacuum pump overspeed.
- C — Vacuum relief valve spring weak.

Answer A. JSAT 11-28 (AC65-15A)

Since the system capacity is more than needed, the adjustable suction relief valve is set for the vacuum desired.

11A-19 N01A

Data transmitted between components in an EFIS are converted into

- A — digital signals.
- B — analog signals.
- C — carrier wave signals.

Answer A. JSAT 11-37

The signals sent to the various components of these systems are typically linked through a digital data bus. These digital signals consist of short pulses of voltage on or voltage off.

11A-20 N01A

The function of a CRT in an EFIS is to

- A — allow the pilot to select the appropriate system configuration for the current flight situation.
- B — display alphanumeric data and representations of aircraft instruments.
- C — receive and process input signals from aircraft and engine sensors and send the data to the appropriate display.

Answer B. JSAT 11-37

The CRT (Cathode Ray Tube) is the television-like screen used to display the information processed by the EFIS.

11A-21 N01A

The function of a symbol generator (SG) in an EFIS is to

- A — receive and process input signals from aircraft and engine sensors and send the data to the appropriate display.
- B — allow the pilot to select the appropriate system configuration for the current flight situation.
- C — display alphanumeric data and representations of aircraft instruments.

Answer A. JSAT 11-36

The symbol generator receives signals from the various instruments and navigational sensors located throughout the aircraft and generates display signals that are sent to the EFIS displays. There may be more than one symbol generator in a complete EFIS system.

11A-22 N01A

The function of a display controller in an EFIS is to

- A — display alphanumeric data and representations of aircraft instruments.
- B — receive and process input signals from aircraft and engine sensors and send the data to the appropriate display.
- C — allow the pilot to select the appropriate system configuration for the current flight situation.

Answer C. JSAT 11-37

The display controller allows the pilot to select the appropriate system configuration for the current flight situation.

11A-23 N01A

A radar altimeter determines altitude by

- A — means of transponder interrogation.
- B — receiving signals transmitted from ground radar stations.
- C — transmitting a signal and receiving back a reflected signal.

Answer C. JSAT 11-8

Radar altimeters operate similar to normal radar, by bouncing signals off the ground and back to the airborne unit. Do not confuse radar altimeters with encoding altimeters, which are connected to the radar transponder.

11A-24 N01A

A radar altimeter indicates

- A — altitude above ground level.
- B — altitude above sea level.
- C — flight level (pressure) altitude.

Answer A. JSAT 11-8

Typically these systems are used at altitudes below 5,000 feet above ground level.

11A-25 N01A

Resistance-type temperature indicators using Wheatstone bridge or ratiometer circuits may be used to indicate the temperatures of which of the following?

1. Free air.
2. Exhaust gas temperature.
3. Carburetor air.
4. Coolant (engine).
5. Oil temperature.
6. Cylinder head temperature.

A — 1, 2, 3, 4, 5, and 6.

B — 1, 2, 3, and 6.

C — 1, 3, 4, and 5.

Answer C. JSAT 11-14

Wheatstone Bridge type temperature indicators are generally used to measure relatively low temperature ranges. High temperature systems, such as EGT or CHT are usually thermocouple type instruments.

11A-26 N01A

When flags such as NAV, HDG, or GS are displayed on an HSI, the indication is

- A — that function is operating.
- B — that function is inoperative.
- C — to call attention to deviation from the desired setting, or flight path, or heading, etc.

Answer B. JSAT 11-26

The flags used on Horizontal Situation Indicators (HSI) tell you that the function indicated on the flag is not operating. This could be because the receiver is not tuned to the proper frequency, the signal being received is unreliable, or the unit is inoperative due to a power interruption.

11A-27 N02A

Which instruments are connected to an aircraft's pitot static system?

1. Vertical speed indicator.
2. Cabin altimeter.
3. Altimeter.
4. Cabin rate-of-change indicator.
5. Airspeed indicator.

A — 1, 2, 3, 4, and 5.

B — 1, 2, and 4.

C — 1, 3, and 5.

Answer C. JSAT 11-31 (AC65-15A)

Vertical speed indicators, altimeters, and airspeed indicators all make use of the aircraft's pitot static system.

11A-28 N02A

How many of the following are controlled by gyroscopes?

1. Attitude indicator.
2. Heading indicator.
3. Turn needle of the turn and slip indicator.

A — Three.

B — One.

C — Two.

Answer A. JSAT 11-18 — 11-22 (AC65-15A)

Three of the most common flight instruments are controlled by gyroscopes: the attitude indicator, heading indicator, and the turn needle of the turn and bank indicator.

11A-29 N02A

The lubber line on a directional gyro is used to

- A — represent the wings of the aircraft.
- B — represent the nose of the aircraft.
- C — align the instrument glass in the case.

Answer B. JSAT 11-18

The lubber line on a directional gyro is used to represent the nose of the aircraft. By using the caging knob on the front of the instrument, the direction the airplane is headed can be adjusted to allow for gyroscope precession.

11A-30 N01A

- (1) Aircraft instruments are color-coded to direct attention to operational ranges and limitations.
- (2) Aircraft instruments range markings are not specified by Title 14 of the Code of Federal Regulations but are standardized by aircraft manufacturers.

Regarding the above statements,

A — only No. 1 is true.

B — both No. 1 and No. 2 are true.

C — only No. 2 is true.

Answer A. JSAT 11-10 — 11-16 (AC65-15A)
Instrument range markings indicate at a glance whether a system or component is operating in a safe range or an unsafe range. FAR 23 lists required instrument markings.

SECTION B

INSTRUMENT SYSTEM INSTALLATION AND MAINTENANCE

Section B of Chapter 11 contains information regarding instrument installations, maintenance, and certification checks.

11B-1 N01A

The maximum deviation (during level flight) permitted in a compensated magnetic direction indicator installed on an aircraft certificated under Federal Aviation Regulation Part 23 is

- A — 10.
- B — 6.
- C — 8.

Answer A. JSAT 11-48

According to FAR 23, the maximum deviation (during level flight) permitted in a magnetic direction indicator installed in an airplane is 10 degrees.

11B-2 N01A

Instrument static system leakage can be detected by observing the rate of change in indication of the

- A — airspeed indicator after suction has been applied to the static system to cause a prescribed equivalent airspeed to be indicated.
- B — altimeter after suction has been applied to the static system to cause a prescribed equivalent altitude to be indicated.
- C — altimeter after pressure has been applied to the static system to cause a prescribed equivalent altitude to be indicated.

Answer B. JSAT 11-49

When suction is applied to the static system in an aircraft, the altimeter is made to read a higher altitude (as a function of the decreased pressure). By observing the rate of change (decreasing altitude) in the altimeter, it is possible to check the static system for leakage.

11B-3 N01A

The maximum altitude loss permitted during an unpressurized aircraft instrument static pressure system integrity check is

- A — 200 feet in 1 minute.
- B — 100 feet in 1 minute.
- C — 50 feet in 1 minute.

Answer B. JSAT 11-49

According to FAR 23, the maximum altitude loss permitted during an unpressurized aircraft instrument static pressure system integrity check is 100 ft. in one minute.

11B-4 N01A

Which of the following instrument discrepancies could be corrected by an aviation mechanic?

1. Red line missing.
2. Case leaking.
3. Glass cracked.
4. Mounting screws loose.
5. Case paint chipped.
6. Leaking at line B nut.
7. Will not adjust.
8. Fogged.

- A — 1, 4, and 6.
- B — 1, 4, 5, and 6.
- C — 3, 4, 5, and 6.

Answer B. JSAT 11-43 (AC65-15A)

Aircraft mechanics are not allowed to repair instruments. They are, however, allowed to put range markings on the glass, tighten mounting screws, touch up the paint on the case, and tighten a "B" nut.

11B-5 N01A

Which of the following instrument discrepancies would require replacement of the instrument?

1. Red line missing.
2. Case leaking.
3. Glass cracked.
4. Mounting screws loose.
5. Case paint chipped.
6. Leaking at line B nut.
7. Will not zero out.
8. Fogged.

A — 1, 3, 5, and 8.

B — 1, 4, 6, and 7.

C — 2, 3, 7, and 8.

Answer C. JSAT 11-43 (AC43.13-1B)

Items 2, 3, 7, and 8 all require disassembly of the instrument and are beyond the capabilities of an A & P technician. A certified repair station is required to perform these duties.

11B-6 N01A

Which of the following instrument conditions is acceptable and would not require correction?

1. Red line missing.
2. Case leaking.
3. Glass cracked.
4. Mounting screws loose.
5. Case paint chipped.
6. Leaking at line B nut.
7. Will not zero out.
8. Fogged.

A — None.

B — 1.

C — 5.

Answer C. JSAT 11-43 (AC65-15A)

The paint being chipped on an instrument case does not require correction. The only difficulty is a cosmetic one.

11B-7 N01A

A synchro transmitter is connected to a synchro receiver

A — electrically with wires.

B — mechanically through linkage.

C — electromagnetically without wires.

Answer A. JSAT 10-11 (AC65-15A)

A selsyn system, which is a synchro-type indicating instrument, consists of a transmitter, an indicator, and connecting wires. An electrical signal is sent from the transmitter to the indicator through wires.

11B-8 N01A

Which of the following causes of aircraft magnetic compass inaccuracies may be compensated for by mechanics?

A — Variation.

B — Magnetic compass current.

C — Deviation.

Answer C. JSAT 11-48 (AC65-15A)

Magnetic compass deviation can be compensated for by a procedure called "swinging the compass". This is accomplished by a certified mechanic at a location on the airport generally called the "compass rose".

11B-9 N01A

Who is authorized to repair an aircraft instrument?

1. A certified mechanic with an airframe rating.
2. A certificated repairman with an airframe rating.
3. A certificated repair station approved for that class instrument.
4. A certificated airframe repair station.

A — 3 and 4.

B — 3.

C — 1, 2, 3, and 4.

Answer B. JSAT 11-45 (AC65-15A, 14CFR Part 65.81)

Instrument repair must be done by an FAA certified instrument repair station. Certified mechanics are not allowed to do instrument repair.

11B-10 N02A

Instrument panel shock mounts absorb

- A — low frequency, high-amplitude shocks.
- B — high G shock loads imposed by turbulent air.
- C — high energy impact shocks caused by hard landings.

Answer A. JSAT 11-45 (AC65-15A)

Instrument panel shock mounts absorb low frequency, high-amplitude shocks. The type and number of shock mounts to be used for instrument panels are determined by the weight of the panel.

11B-11 N02A

Which procedure should you use if you find a vacuum operated instrument glass loose?

- A — Mark the case and glass with a slippage mark.
- B — Replace the glass.
- C — Install another instrument.

Answer C. JSAT 11-43 (AC65-15A)

Instrument repair, which includes the replacement of an instrument's glass face, is allowed to be done by instrument repair stations only. A certified mechanic would need to replace the instrument.

11B-12 N02A

How many of the following instruments will normally have range markings?

1. Airspeed indicator.
2. Altimeter.
3. Cylinder head temperature gauge.

- A — Two.
- B — One.
- C — Three.

Answer A. JSAT 11-45

Airspeed indicators and cylinder head temperature gages will both have range markings indicated on their faces or cover glass.

11B-13 N02A

How would an airspeed indicator be marked to show the best rate of climb speed (one engine inoperative)?

- A — A green arc.
- B — A blue radial line.
- C — A red radial line.

Answer B. JSAT 11-46

An airspeed indicator is marked with a blue radial line to indicate the best rate-of-climb speed with one engine inoperative.

11B-14 N02A

The green arc on an aircraft temperature gauge indicates

- A — the instrument is not calibrated.
- B — a low, unsafe temperature range.
- C — the desirable temperature range.

Answer C. JSAT 11-46 (AC65-15A)

Green arcs used on aircraft instruments indicate normal or desirable ranges.

11B-15 N02A

What must be done to an instrument panel that is supported by shock mounts?

- A — Bonding straps must be installed across the instrument mounts as a current path.
- B — The instrument mounts must be grounded to the aircraft structure as a current path.
- C — The instrument mounts must be tightened to the specified torque required by the maintenance manual.

Answer A. JSAT 11-45 (AC65-15A)

A bonding strap must be used to complete the circuit that is broken when the nonconductive shock mount is installed.

11B-16 N02A

What marking color is used to indicate if a cover glass has slipped?

- A — Yellow.
- B — White.
- C — Red.

Answer B. JSAT 11-45 (AC65-15A)
White index marks are used on the glass and case of aircraft instruments to indicate whether the glass has slipped.

11B-17 N02A

Aircraft instruments should be marked and graduated in accordance with

- A — both the aircraft and engine manufacturers' specifications.
- B — the instrument manufacturer's specifications.
- C — the specific aircraft maintenance or flight manual.

Answer C. JSAT 11-45 (AC65-15A)
Instruments should be marked and graduated in accordance with the Aircraft Specifications or Type Certificate Data Sheets and the specific aircraft maintenance or flight manual.

11B-18 N02A

Aircraft instrument panels are generally shock mounted to absorb

- A — low frequency, high amplitude shocks.
- B — high frequency, high amplitude shocks.
- C — all vibration.

Answer A. JSAT 11-45 (AC65-15A)
Instrument panels are usually shock-mounted to absorb low frequency, high amplitude shocks. The mounts are used in sets of two, each secured to separate brackets.

11B-19 N02A

The method of mounting aircraft instruments in their respective panels depends on the

- A — instrument manufacturer.
- B — design of the instrument panel.
- C — design of the instrument case.

Answer C. JSAT 11-44 (AC65-15A)
The method of mounting instruments on their respective panels depends on the design of the instrument case. Depending on their design, they can be mounted from the front or from the rear of the panel.

11B-20 N02A

How is a flangeless instrument case mounted in an instrument panel?

- A — By four machine screws which extend through the instrument panel.
- B — By an expanding type clamp secured to the back of the panel and tightened by a screw from the front of the instrument panel.
- C — By a metal shelf separate from and located behind the instrument panel.

Answer B. JSAT 11-44 (AC65-15A)
An instrument with a flangeless case is mounted from the front of the panel. A special expanding type of clamp, shaped and dimensioned to fit the instrument case, is secured to the rear face of the panel.

11B-21 N01A

The requirements for testing and inspection of instrument static systems required by Section 91.411 are contained in

- A — AC 43.13-1A.
- B — Type Certificate Data Sheets.
- C — Part 43, appendix E.

Answer C. JSAT 11-33 (FAR Part 43, Appendix E)
FAR 43, Appendix E lists the inspection items that meet the requirements of FAR 91.411.

11B-22 N02A

When installing an instrument in an aircraft, who is responsible for making sure it is properly marked?

- A — The instrument manufacturer.
- B — The aircraft owner.
- C — The instrument installer.

Answer C. JSAT 11-45

According to FAR 43, whenever a mechanic works on an aircraft system, the work must be performed in such a way that the finished product is at least equal to the original or properly altered condition. Ensuring that an instrument is properly marked is the responsibility of the installing person or agency.

11B-23 N02A

Where may a person look for the information necessary to determine the required markings on an engine instrument?

1. Engine manufacturer's specifications.
2. Aircraft flight manual.
3. Instrument manufacturer's specifications.
4. Aircraft maintenance manual.

- A — 2 or 4.
- B — 2 or 3.
- C — 1 or 4.

Answer A. JSAT 11-45 (AC65-9A)

Instruments should be marked and graduated in accordance with the Aircraft Specifications or Type Certificate Data Sheets and the specific aircraft maintenance or flight manual.

11B-24 N02A

A certificated mechanic with airframe and power plant ratings may

- A — perform minor repairs to aircraft instruments.
- B — not perform repairs to aircraft instruments.
- C — perform minor repairs and minor alterations to aircraft instruments.

Answer B. JSAT 11-45 (14CFR Part 65.81)

According to FAR 65, a limitation imposed on certified mechanics is that they cannot perform repairs to instruments.

11B-25 N02A

The red radial lines on the face of an engine oil pressure gauge indicates

- A — minimum engine safe RPM operating range.
- B — minimum precautionary safe operating range.
- C — minimum and/or maximum safe operating limits.

Answer C. JSAT 11-47 (AC65-15A)

A red radial line on an aircraft instrument is used to indicate maximum or minimum safe operating limits.

11B-26 N02A

A certificated mechanic may perform

- A — minor repairs to instruments.
- B — instrument overhaul.
- C — 100-hour inspections of instruments.

Answer C. JSAT 11-45 (14CFR Part 65.81)

According to FAR 65, a certified mechanic is authorized to perform a 100-hour inspection of an aircraft. This includes the inspection of the instruments.

11B-27 N02A

An aircraft instrument panel is electrically bonded to the aircraft structure to

- A — act as a restraint strap.
- B — provide current return paths.
- C — aid in the panel installation.

Answer B. JSAT 11-45 (AC65-15A)

An aircraft instrument panel needs to be bonded to the aircraft structure to prevent the buildup of stray electrical charges and to provide current return paths for electrical instruments. This is often accomplished with braided bonding straps that bypass the shock mounts.

11B-28 N02A

When an unpressurized aircraft's static pressure system is leak checked to comply with the requirements of Section 91.411, what aircraft instrument may be used in lieu of a pitot-static system tester?

1. Vertical speed indicator.
2. Cabin altimeter.
3. Altimeter.
4. Cabin rate-of-change indicator.
5. Airspeed indicator.

A — 2 or 4.

B — 1 or 5.

C — 3.

Answer C. JSAT 11-49

If the static system has been sealed off with the altimeter reading 1000 feet above ground level, the system leakage should not allow the altimeter to drop more than 100 feet in one minute.

11B-29 N02A

If a static pressure system check reveals excessive leakage, the leak(s) may be located by

- A — pressurizing the system and adding leak detection dye.
- B — isolating portions of the line and testing each portion systematically, starting at the instrument connections.
- C — removing and visually inspecting the line segments.

Answer B. JSAT 11-49

Start with the portion of the system connected to the instruments and work back toward the static ports.

11B-30 N02A

When performing the static system leakage check required by Section 91.411, the technician utilizes

A — static pressure.

B — negative pressure.

C — positive pressure.

Answer B. JSAT 11-49

Static system leak tests are performed at pressures below atmospheric.

11B-31 N01A

An aircraft magnetic compass is swung to up-date the compass correction card when

A — the compass is serviced.

B — equipment is added that could effect compass deviation.

C — an annual inspection is accomplished on the aircraft.

Answer B. JSAT 11-25 (AC65-15A)

An aircraft's magnetic compass is swung to correct for magnetic disturbances within the aircraft, called deviation.

AIRCRAFT AVIONICS SYSTEMS

SECTION A AVIONICS FUNDAMENTALS

This section contains information regarding fundamental elements of electronic communication and navigation equipment.

12A-1 O02A

When must the radio station license be displayed in an aircraft equipped with a two-way radio?

- A — When the aircraft is certified for IFR flight.
- B — When the aircraft is operated outside the U.S.
- C — When the aircraft is returned to service.

Answer B. JSAT 14-23

Radio station license is not required for domestic flights.

12A-2 O02A

When would a U.S. resident NOT be required to hold a Federal Communications Commission (FCC) Restricted Radio Telephone Operator Permit to operate two-way aircraft VHF radio equipment?

- A — When flying or communicating within the United States.
- B — When flying to or communicating with destinations outside the United States.
- C — When the radio equipment is operated in aircraft certified for VFR flight only.

Answer A. (FCC Regulations)

An FCC Restricted Radio Telephone Operator Permit is only required when flying to or communicating with destinations outside the United States.

12A-3 O02A

Part of the ADF system used on aircraft includes

- A — sense and loop antennas.
- B — RMI indicator antenna.
- C — marker beacon antenna.

Answer A. JSAT 12-14 (AC65-15A)

The ADF system uses the combination of an omnidirectional sense antenna, and a highly directional loop antenna. In the ADF mode the field patterns of the two antennas are combined into what is known as a cardioid pattern.

12A-4 O02A

An emergency locator transmitter (ELT) battery must be capable of furnishing power for signal transmission for at least

- A — 48 hours.
- B — 36 hours.
- C — 72 hours.

Answer A. JSAT 12-25 (AC65-15A)

The life of the battery is the length of time which the battery may be stored without losing its ability to continuously operate the ELT for 48 hours.

12A-5 O02A

The preferred location of an ELT is

- A — where it is readily accessible to the pilot or a member of the flightcrew while the aircraft is in flight.
- B — as far aft as possible, but forward of the vertical fin.
- C — as far aft as possible.

Answer B. JSAT 12-25 (AC65-15A)

An emergency locator transmitter may be located anywhere within the aircraft, but the ideal location is as far aft as possible, but just forward of the vertical fin.

12A-6 O02A

An emergency locator transmitter (ELT) is normally activated by an inertial switch or equivalent mechanism if subjected to a force of a prescribed intensity and duration. It must activate when the force is applied

- A — parallel to the longitudinal axis of the aircraft.
- B — in any direction relative to the aircraft axes.
- C — parallel to the vertical axis of the aircraft.

Answer A. JSAT 12-25 (AC91-94A)

To meet the "G" force requirements of TSO-C91, automatic fixed-type inertially activated ELTs must activate at any inertial force, parallel to the longitudinal axis of the aircraft of 5 Gs (+2, -0) and greater for a time duration of 11 (+5, -0) milliseconds or longer.

12A-7 O02A

How may the battery replacement date be verified for an emergency locator transmitter (ELT)?

- A — By activating the transmitter and measuring the signal strength.
- B — By removing the batteries and testing them under a measured load to determine if 50 percent of the useful life remains.
- C — By observing the battery replacement date marked on the outside of the transmitter.

Answer C. JSAT 12-25 (AC65-15A)

The battery replacement date for an emergency locator transmitter must be marked on the outside of the transmitter.

12A-8 O02A

How may the operation of an installed emergency locator transmitter (ELT) be verified during aircraft inspection?

- A — By moving the deactivating switch from the DISARM position to the ARM position, while monitoring the civil emergency frequency with a communications receiver at five minutes after the hour.
- B — By tuning a communications receiver to the civil emergency frequency, and activating the ELT momentarily within five minutes after the hour.
- C — By activating the 5 g switch and turning the unit on at five minutes after the hour.

Answer B. JSAT 12-25 (AC65-15A)

Testing of ELTs should be coordinated with the nearest FAA Tower or Flight Service Station. Tests should be conducted only during the first five minutes of any hour and should be restricted to 3 audio sweeps. The ELT can be checked by tuning a VHF communication receiver to 121.5 MHz and listening for ELT audio sweeps.

12A-9 O02A

Long Range Navigation (LORAN) systems determine aircraft location by

- A — measuring the inertial forces acting on the aircraft.
- B — means of pulsed signals transmitted from ground stations.
- C — means of signals transmitted to and from navigation satellites.

Answer B. JSAT 12-19

Airborne LORAN systems choose a master and two or more secondary ground stations.

12A-10 O02A

VHF radio signals are commonly used in

- A — both VOR navigation and ATC communications.
- B — ATC communications.
- C — VOR navigation.

Answer A. JSAT 12-10, 12-14

VOR stations as well as the vast majority of aeronautical communications operate in the VHF band of frequencies.

12A-11 O02A

In the landing configuration GPWS typically monitors the radio (radar) altimeter; air data computer; instrument landing system, and

- A — aileron, rudder, and elevator positions.
- B — landing gear and flap positions.
- C — spoiler, slat, and stabilizer positions.

Answer B. JSAT 12-26

The Ground Proximity Warning System (GPWS) is used to warn the pilot of excessively low altitude. In the landing mode, it monitors the gear and flaps for proper position for landing.

12A-12 O02A

In general, the purpose of an aircraft transponder is to

- A — continually transmit heading, speed, and rate of climb/decent etc. information to ATC.
- B — monitor aircraft speed, heading, altitude, and attitude whenever the autopilot system is engaged.
- C — receive an interrogation signal from a ground station and automatically send a reply back.

Answer C. JSAT 12-22

The transponder provides reliable information to the air traffic controller as to the location of a specific aircraft. The aircraft's equipment responds to interrogation by from ground based equipment.

12A-13 O03A

One antenna can be used for the radio range and standard broadcast bands in light aircraft because the

- A — antenna is omnidirectional.
- B — antenna length may be electronically adjusted.
- C — two ranges are close together.

Answer C. JSAT 12-3 (AC65-15A)

One antenna can be used to receive both low frequency radio range and standard broadcast signals because the two signals are very close together.

12A-14 O03A

The purpose of a localizer is to

- A — set the airplane on the proper approach angle to the runway.
- B — indicate the distance the airplane is from the end of the runway.
- C — align the airplane with the center of the runway.

Answer C. JSAT 12-23 (AC65-15A)

An instrument landing system consists of a runway localizer, a glide slope signal, and marker beacons for position location. The localizer equipment produces a radio course aligned with the center of an airport runway.

12A-15 O03A

The purpose of a glideslope system is to

- A — indicate the distance the airplane is from the end of the runway.
- B — assist the pilot in making a correct angle of descent to the runway.
- C — provide for automatic altitude reporting to air traffic control.

Answer B. JSAT 12-23 (AC65-15A)

The glide slope is a radio beam which provides vertical guidance to the pilot, assisting him in making the correct angle of descent to the runway.

12A-16 O03A

(Refer to Airframe figure 16) Which of the antennas shown is a typical DME antenna?

- A — 1.
- B — 2.
- C — 4.

Answer A. JSAT 12-32
A typical DME antenna is a blade type.

12A-17 O03A

(Refer to Airframe figure 16) Which of the antennas shown is a typical glideslope antenna?

- A — 2.
- B — 3.
- C — 4.

Answer A. JSAT 12-30 (AC65-15A)
A typical glide slope antenna is the shape of a lower-case "m" laying on its side.

12A-18 O02A

When must the emergency locator transmitter (ELT) battery be replaced (other than reading the replacement date)?

- A — When the transmitter has been tested more than ten times.
- B — When the transmitter has been in use for more than one cumulative hour.
- C — Must be replaced annually or if the five G switch has been activated.

Answer B. (FAR 91.207, AC65-15A)
ELT batteries must be replaced after the transmitter has been in use for more than one cumulative hour.

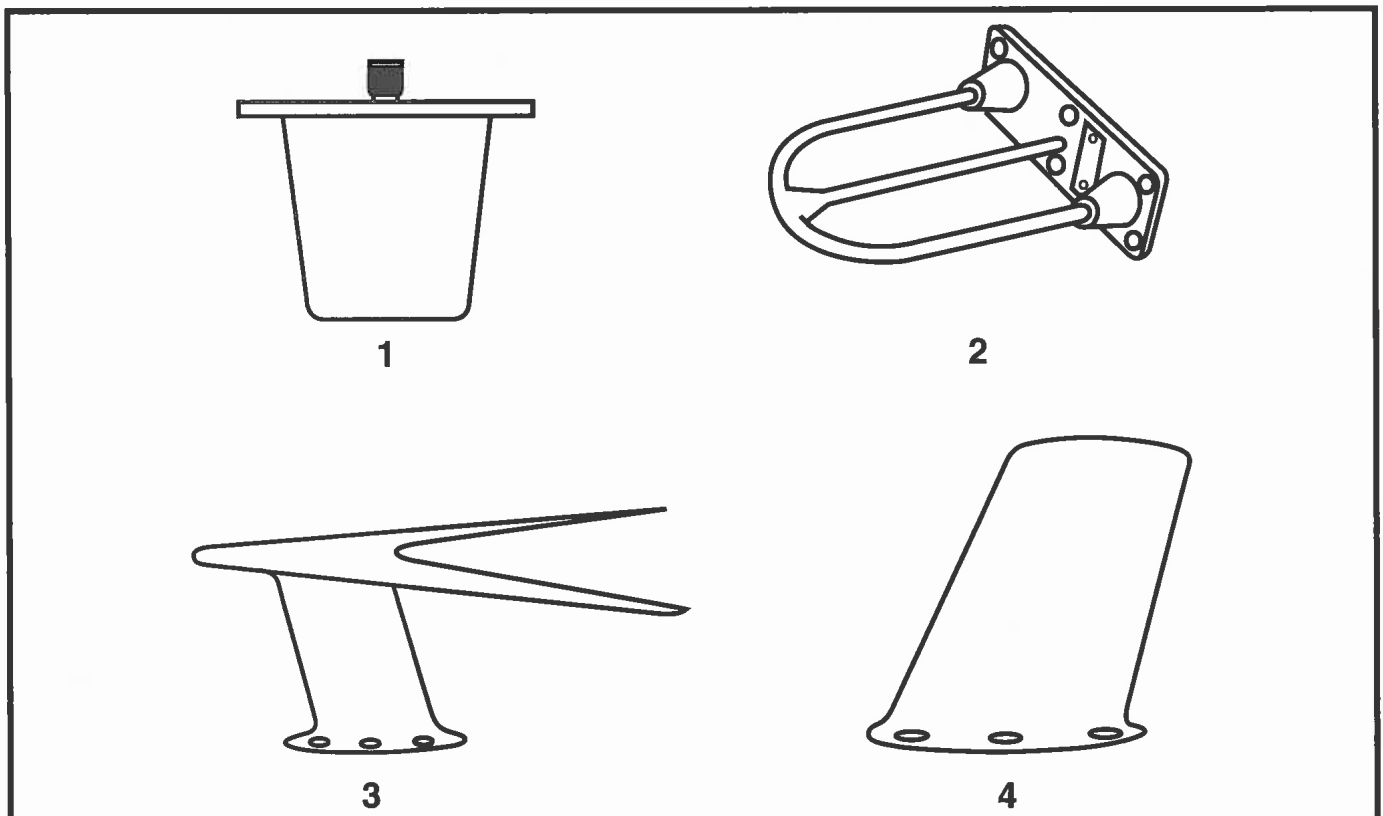


Figure 16. — Antennas

SECTION B

AUTOPILOTS AND FLIGHT DIRECTORS

Section B of Chapter 12 contains autopilot and flight director information, including operating theory, installation, and maintenance.

12B-1 O01A

What is the primary purpose of an autopilot?

- A — To fly a more precise course for the pilot.
- B — To obtain the navigational aid necessary for extended over water flights.
- C — To relieve the pilot of control of the aircraft during long periods of flight.

Answer C. JSAT 12-34 (AC65-15A)

The purpose of an automatic pilot system is primarily to reduce the work strain, and fatigue of controlling the aircraft during long flights.

12B-2 O01A

Which of the following provides manual maneuverability of the aircraft while the autopilot is engaged?

- A — Directional gyro indicator.
- B — Servo amplifier.
- C — Flight controller.

Answer C. JSAT 12-35 (AC65-15A)

While the automatic pilot system is engaged, the manual operation of the various knobs on the controller allows the pilot to maneuver the aircraft.

12B-3 O01A

In an autopilot, which signal nullifies the input signal to the ailerons?

- A — Course signal.
- B — Follow-up signal.
- C — Displacement signal.

Answer B. JSAT 12-37 (AC65-15A)

As the aileron surfaces move, a follow-up signal builds up in opposition to the input signal. When the two signals are equal in magnitude, the servo stops moving.

12B-4 O01A

In which control element of an autopilot system is an attitude indicator?

- A — Sensing.
- B — Command.
- C — Input.

Answer A. JSAT 12-37 (AC65-15A)

The directional gyro, turn-and-bank gyro, attitude gyro, and altitude control are the sensing elements in an autopilot system. These units sense the movements of the aircraft, and automatically generate signals to keep these movements under control.

12B-5 O01A

What is the operating principle of the sensing device used in an autopilot system?

- A — The rate of change of motion between the gyro gimbal rings and the aircraft.
- B — The reaction of the force 90° away from the applied force in the direction of gyro rotation.
- C — The relative motion between a gyro and its supporting system.

Answer C. JSAT 12-36

In an autopilot system, attitude is sensed by the relationship between the gyros and their supporting systems.

12B-6 O01A

What will occur if an aircraft attitude is changed by its autopilot system in order to correct for an error and the involved control surfaces are returned to streamline by the time the aircraft has reached its correct position?

- A — Normal operation.
- B — Overshoot and oscillation.
- C — Undershoot and oscillation.

Answer A. JSAT 12-37

If the control surfaces were not returned to neutral until the desired position is reached, the inertia of the aircraft would keep it moving in the same direction until it caused a gyro to sense a new error and send a signal to correct. This overshoot and correct would begin a series of oscillations that would cause the aircraft to rock its wings violently. The follow-up system prevents this from happening.

12B-7 O01A

What component of an autopilot system applies torque to the control surfaces of an aircraft?

- A — Controller.
- B — Gyro.
- C — Servo.

Answer C. JSAT 12-38 (AC65-15A)

In an autopilot system, the servo is the device which is connected to the control surface and converts the electrical signals into mechanical force to move the control surface.

12B-8 O01A

What is the main purpose of a servo in an autopilot system?

- A — Correct for displacement of the aircraft about its axis.
- B — Move the control surface as commanded.
- C — Change mechanical energy to electrical energy.

Answer B. JSAT 12-37 (AC65-15A)

In an autopilot system, servomotors are the devices which apply the mechanical force to move the control surfaces. Electrical and electro/pneumatic are typical of the servos in use today.

12B-9 O01A

Which channel of an autopilot detects changes in pitch attitude of an aircraft?

- A — Aileron.
- B — Elevator.
- C — Rudder.

Answer B. JSAT 12-34 (AC65-15A)

The elevator channel circuits detect changes in the pitch attitude of the aircraft.

12B-10 O01A

The elevator channel of an autopilot controls the aircraft about which axis of rotation?

- A — Lateral.
- B — Roll.
- C — Longitudinal.

Answer A. JSAT 12-34 (AC65-15A)

The elevator of an aircraft provides control about the lateral axis.

12B-11 O01A

What component is the sensing device in an electromechanical autopilot system?

- A — Gyro.
- B — Servo.
- C — Controller.

Answer A. JSAT 12-35 (AC65-15A)

The directional gyro, turn-and-bank gyro, attitude gyro and the altitude control are the sensing elements. They sense the movements of the aircraft and automatically generate signals to keep these movements under control.

12B-12 O01A

A fully integrated autopilot controls the aircraft around how many axes?

- A — Four.
- B — Two.
- C — Three.

Answer C. JSAT 12-34

A fully integrated autopilot controls the aircraft around all three axes.

12B-13 O01A

Dutch roll, a combination yawing and rolling oscillation that affects many swept wing aircraft, is counteracted with

- A — a yaw damper system.
- B — an aileron damper system.
- C — a flight director system

Answer A.

Dutch roll is a combined roll and yaw condition. It is sensed by the yaw dampers and counteracted by the rudder servo system.

12B-14 O01A

When operationally checking an autopilot system on the ground, after the aircraft's main power has been switched on, the autopilot should be engaged

- A — only after the gyros come up to speed and the amplifier warms up.
- B — for only a few minutes at a time.
- C — whenever the operator desires.

Answer A. JSAT 12-47 (AC65-15A)

After the aircraft's main power switch has been turned on, allow the gyros to come up to speed and the amplifiers to warm up before engaging the autopilot.

12B-15 O02A

On modern large aircraft, what electronic device typically monitors flight parameters and performs autopilot functions?

- A — Control/display unit.
- B — Transponder.
- C — Flight management computer.

Answer C. JSAT 12-39

The Flight Management Computer is the main memory unit of a Flight Management System.

SECTION C

INSTALLATION AND MAINTENANCE OF AVIONICS

Section C of Chapter 12 contains information regarding the installation of communication and navigation radios and associated antenna installation practices.

12C-1 O02A

Installed radio equipment is protected from damage due to jolts and vibration by

- A — shock mounts.
- B — spring and/or viscous damper mounted racks.
- C — rubber or foam cushioning material between circuit chassis and case.

Answer A. JSAT 12-55 (AC65-15A)
Radio equipment is sensitive to mechanical shock and vibration and is normally shock mounted to provide protection.

12C-2 O02A

(1) Use solder to attach bonding jumpers on radio equipment.

(2) Radio equipment is bonded to the aircraft in order to provide a low impedance ground and to minimize radio interference from static electrical charges. Regarding the above statements,

- A — only No. 2 is true.
- B — only No. 1 is true.
- C — both No. 1 and No. 2 are true.

Answer A. JSAT 12-50, JSAT 12-51 (AC43.13-2A)
It is advisable to bond radio equipment to the aircraft in order to provide a low impedance ground and to minimize radio interference from static electrical charges. When attaching bonding jumpers, the use of solder should be avoided.

12C-3 O02A

When installing coaxial cable, it should be secured firmly along its entire length

- A — wherever the cable sags.
- B — at 1-foot intervals.
- C — at 2-foot intervals.

Answer C. (AC43.13-1B AC65-15A)
When installing coaxial cable (transmission lines), secure the cables firmly along their entire length at intervals of approximately 2 ft. To assure optimum operation, coaxial cables should not be routed or tied to other wire bundles.

12C-4 O03A

How much clearance from the seat bottom is required when installing radio equipment under a seat?

- A — No set minimum as long as the equipment receives adequate cooling and damage protection.
- B — 3 inches with the seat unoccupied.
- C — 1 inch with the seat occupied and subjected to maximum downward seat spring deflection.

Answer C. (AC43.13-2A)
AC 43.13-2A, Figure 2.6 — typical under seat installation requires 1" clearance when the seat springs are deflected to the maximum allowed under 6.6 g's for a 170 pound standard passenger weight.

12C-5 O02A

Static dischargers help eliminate radio interference by dissipating static electricity into the atmosphere at

- A — low current levels.
- B — high voltage level.
- C — high current levels.

Answer A.

The lower level of discharge current produces an extremely weak magnetic field which is not picked up by radio receivers.

12C-6 O02A

An aircraft antenna installation must be grounded

- A — to the airframe.
- B — to the radio rack.
- C — to the engine.

Answer A. JSAT 12-57

Aircraft antennae require a ground plane for proper operation. This is normally accomplished by grounding the antenna to the airframe at the point of attachment.

12C-7 O03A

When an antenna is installed, it should be fastened

- A — to the primary structure at the approximate intersection of the three aircraft axes.
- B — with a reinforcing doubler on each side of the aircraft skin.
- C — so that loads imposed are transmitted to the aircraft structure.

Answer C. JSAT 12-58 (AC43.13-2A)

When attaching an antenna mounting (masts, base receptacles, and/or supporting brackets) it should be done so that the loads imposed are transmitted to the aircraft structure.

12C-8 O03A

After an automatic direction finding antenna has been installed, the

- A — loop must be calibrated.
- B — antenna must be grounded.
- C — transceiver must be compensated.

Answer A. JSAT 12-60 (AC43.13-2A)

After completing the installation of an ADF antenna, it is essential that the loop be calibrated. This can be done in accordance with 43.13-1B, Chapter 12.

12C-9 O03A

Doublers are used when antennas are installed to

- A — prevent oil canning of the skin.
- B — eliminate antenna vibration.
- C — reinstate the structural strength of the aircraft skin.

Answer C. JSAT 12-58 (AC65-15A)

When installing a typical rigid antenna, a reinforcing doubler of sufficient thickness to reinforce the skin should be used.

12C-10 O03A

What characteristics of the installation of a rigid antenna on a vertical stabilizer should be evaluated?

- A — Polarization and impedance.
- B — Flutter and vibration.
- C — Impedance and interference.

Answer B. JSAT 12-55 (AC43.13-2A)

When a rigid antenna is installed on a vertical stabilizer, the technician should evaluate the flutter and vibration characteristics of the installation.

12C-11 O03A

A gasket or sealant is used between the antenna mast and fuselage skin

- A — for aircraft pressurization only.
- B — to prevent the entry of moisture.
- C — to prevent abrasion between the antenna mast and fuselage skin.

Answer B. JSAT 12-57 (AC65-15A)

When installing an antenna, the technician should make sure that the mounting bolts are tightened firmly against the reinforcing doubler and that the mast is drawn tight against the gasket. If a gasket is not used, the technician should seal between the mast and the fuselage with a suitable sealer, such as zinc chromate paste. The gasket or sealant is used to preclude the entry of moisture.

12C-12 O03A

The preferred location of a VOR antenna on light aircraft is on

- A — top of the cabin with the apex of the V pointing forward.
- B — top of the vertical stabilizer.
- C — the bottom of the fuselage and as far forward as possible.

Answer A. JSAT 12-59, JSAT 12-60 (AC43.13-2A)

A good location for the VOR localizer receiving antenna on many small airplanes is over the forward part of the cabin. Mount the rigid V-type antenna so that the apex of the "V" points forward and the plane of the "V" is level in normal flight.

12C-13 O03A

A DME antenna should be located in a position on the aircraft that will

- A — permit interruptions in DME operation.
- B — not be blanked by the wing when the aircraft is banked.
- C — eliminate the possibility of the DME locking on a station.

Answer B. JSAT 12-59 (AC65-15A)

To prevent an interruption in DME operation, the antenna must be located in a position that will not be blanked by the wing when the aircraft is banked.

12C-14 O03A

When bending coaxial cable, the bend radius should be at least

- A — 10 times the diameter of the cable.
- B — 15 times the diameter of the cable.
- C — 20 times the diameter of the cable.

Answer A. JSAT 12-56 (AC65-15A)

When bending coaxial cable, be sure the bend is at least 10 times the size of the cable diameter.

12C-15 O03A

When installing a DME antenna, it should be aligned with the

- A — centerline on the airplane.
- B — angle of incidence.
- C — null position.

Answer A. JSAT 12-59

A DME antenna should be installed so it runs parallel with the center line of the aircraft.

12C-16 O03A

The addition of avionics and associated antenna systems forward of the CG limit will affect

- A — CG limits and useful load.
- B — useful load and maximum gross weight.
- C — empty weight and useful load.

Answer C. JSAT 6-21

The addition of any equipment will affect both the empty weight and the aircraft useful load.

12C-17 O03A

(Refer to Airframe figure 15) What is the approximate drag load on an antenna with a frontal area of .125 square feet installed on an aircraft with a speed of 225 MPH?

$$D = .000327AV^2$$

A — 2.080 pounds.

B — 2.069 pounds.

C — 2.073 pounds.

Answer B. (AC43.13-2A)

The formula given for antenna drag is $D = .000327AV^2$. In this case:

$$D = .000327 \times .125 \times (225)^2 =$$

$$D = .000327 \times .137 \times 75,625 = 2.069 \text{ lbs.}$$

12C-18 O03A

(Refer to Airframe figure 15) What is the approximate drag load on an antenna with a frontal area of .137 square feet installed on an aircraft with a speed of 275 MPH?

$$D = .000327AV^2$$

A — 3.592 pounds.

B — 3.387 pounds.

C — 3.741 pounds.

Answer B. (AC43.13-2A)

The formula given for antenna drag is $D = .000327AV^2$. In this case:

$$D = .000327 \times .137 \times (275)^2 =$$

$$D = .000327 \times .137 \times 75,625 = 3.387 \text{ lbs.}$$

$$D = .000327AV^2$$

Figure 15. — Formula

AIRFRAME ICE AND RAIN CONTROL

SECTION A AIRFRAME ICE CONTROL SYSTEMS

Section A of Chapter 13 contains information regarding windshield, instrument, and airfoil anti-ice and de-ice systems.

13A-1 S01A

When installing pneumatic surface-bonded type deicer boots,

- A — apply a solution of glycerin and water between the rubber and the wing skin.
- B — apply a silastic compound between the boot and the wing skin.
- C — remove all paint from the area to be covered by the deicer boot.

Answer C. JSAT 13-12 (AC65-15A)
Before installing pneumatic surface-bonded deicer boots, the installation area must be thoroughly cleaned and all paint removed before the glue is applied.

13A-2 S01A

Which of the following are found in a laminated integral electrically heated windshield system?

1. Autotransformer.
2. Heat control relay.
3. Heat control toggle switch.
4. 24V DC power supply.
5. Indicating light.

- A — 2, 3, 4, and 5.
- B — 1, 2, 3, and 5.
- C — 1, 2, 4, and 5.

Answer B. JSAT 13-6 (AC65-15A)
Laminated windshields which have integral heaters incorporate autotransformers, heat control relays, heat control toggle switches, and indicating lights. The heating elements are powered by the 115 volt AC bus.

13A-3 S01A

What is one check for proper operation of a pitot/static tube heater after replacement?

- A — Ammeter reading.
- B — Continuity check of system.
- C — Voltmeter reading.

Answer A. JSAT 13-6 (AC65-15A)
To check if a pitot/static tube heater is operating properly, turn the heater on and observe the ammeter reading. The needle on the gage should move to indicate current flow.

13A-4 S01A

What controls the inflation sequence in a pneumatic deicer boot system?

- A — Vacuum pump.
- B — Shuttle valve.
- C — Distributor valve.

Answer C. JSAT 13-8 (AC65-15A)
In a pneumatic deicer boot system, the distributor valve accepts the air from the compressor and directs it to the boots in the proper sequence.

13A-5 S01A

What is the source of pressure for inflating deicer boots on reciprocating engine aircraft?

- A — Vane type pump.
- B — Piston type pump.
- C — Gear type pump.

Answer A. JSAT 13-10 (AC65-15A)

On a typical reciprocating engine airplane, the deicer boots are powered by a rotary, four-vane positive-displacement pump. The pressure side of the pump inflates the boots, and the suction side of the pump holds the boots down when they are not inflated.

13A-6 S01A

Which of the following regulates the vacuum of the air pump to hold the deicing boots deflated when the pneumatic deicing system is off?

- A — Distributor valve.
- B — Pressure regulator.
- C — Suction relief valve.

Answer C. (AC65-15A)

The suction side of the pressure pump, regulated by a suction relief valve, holds the deicing boots deflated when they are not in use.

13A-7 S01A

What may be used to clean deicer boots?

- A — Unleaded gasoline or Jet A fuel.
- B — Naphtha.
- C — Soap and water.

Answer C. JSAT 13-12 (AC65-15A)

Deicer boots should be cleaned using mild soap and water solution.

13A-8 S01A

Some aircraft are protected against airframe icing by heating the leading edges of the airfoils and intake ducts. When is this type of anti ice system usually operated during flight?

- A — Whenever icing conditions are first encountered or expected to occur.
- B — In symmetric cycles during icing conditions to remove ice as it accumulates.
- C — Continuously while the aircraft is in flight.

Answer A. JSAT 13-3 (AC65-15A)

Anti-icing systems which heat the leading edges of wings and intake ducts are generally operated when icing conditions are encountered or when they are expected to occur.

13A-9 S01A

Which of the following indications occur during a normal operational check of a pneumatic deicer system?

- A — Pressure and vacuum gauges will fluctuate as the deicer boots inflate and deflate.
- B — Relatively steady readings on the pressure gauge and fluctuating readings on the vacuum gauge.
- C — Fluctuating readings on the pressure gauge and relatively steady readings on the vacuum gauge.

Answer C. JSAT 13-10 (AC65-15A)

With the deicer system controls in the proper positions, the suction and pressure gages for the pneumatic deicer system can be checked. The pressure gage will fluctuate as the deicer tubes inflate and deflate. A relatively steady reading should be maintained on the vacuum gage.

13A-10 S01A

What method is usually employed to control the temperature of an anti icing system using surface combustion heaters?

- A — Thermostats in the cockpit.
- B — Heater fuel shutoff valves.
- C — Thermo cycling switches.

Answer C. JSAT 13-3 (AC65-15A)

An anti-icing system using surface combustion heaters is automatically controlled by overheat switches, thermal cycling switches, a balance control, and a duct pressure safety switch. The overheat and cycling switches allow the heaters to operate at periodic intervals, and they also stop the heater operation completely if overheating occurs.

13A-11 S01A

What is the purpose of the distributor valve in a deicing system utilizing deicer boots?

- A — To sequence the deicer boots inflations symmetrically.
- B — To distribute anti-icing fluid to the deicer boots.
- C — To equalize the air pressure to the left and right wings.

Answer A. JSAT 13-8 (AC65-15A)

In a pneumatic deicer boot system, the distributor valve sequences the inflating and deflating of the different boots in the system.

13A-12 S01A

What is the purpose of the oil separator in the pneumatic deicing system?

- A — To prevent an accumulation of oil in the vacuum system.
- B — To remove oil from air exhausted from the deicer boots.
- C — To protect the deicer boots from oil deterioration.

Answer C. JSAT 13-10 (AC65-15A)

In a pneumatic deicer boot system, an oil separator is provided for each wet-type air pump. Each separator has an air inlet port, an air outlet port, and an oil drain line which is routed back to the engine oil sump. Since the air pump is internally lubricated, it is necessary to provide a means of separating oil from the pressurized air. If this were not done, the oil could damage the deicer boots.

13A-13 S01A

Where are the heat sensors located on most aircraft with electrically heated windshields?

- A — Imbedded in the glass.
- B — Around the glass.
- C — Attached to the glass.

Answer A. JSAT 13-6 (AC65-15A)

On most electrically heated windshields, the thermistor-type heat sensors are imbedded in the glass.

13A-14 S01A

What maintains normal windshield temperature control in an electrically heated windshield system?

- A — Thermistors.
- B — Electronic amplifiers.
- C — Thermal overheat switches.

Answer A. JSAT 13-6 (AC65-15A)

Windshield temperature control in an electrically heated windshield is normally maintained by thermistors. A thermistor is a device in which the resistance changes with the temperature. When placed in series in an electrical circuit, the thermistor will cause the current flow in the circuit to change as temperature changes.

13A-15 S01A

Arcing in an electrically heated windshield panel usually indicates a breakdown in the

- A — temperature sensing elements.
- B — conductive coating.
- C — autotransformers.

Answer B. JSAT 13-6 (AC65-15A)

Arcing in a windshield panel usually indicates that there is a breakdown in the conductive coating. Where arcing exists, there is invariably a certain amount of local overheating which, depending upon its severity and location, can cause further damage to the panel.

13A-16 S01A

Which of the following connects vacuum to the deicer boots when the systems is not in operation, to hold the boots tightly against the leading edges in flight?

- A — Distributor valve.
- B — Ejector.
- C — Vacuum relief valve.

Answer A. (AC65-15A)

The distributor valve in a pneumatic deicer boot system directs the pressure air and the suction to the deicer boot, depending on whether the boot is being inflated or deflated.

13A-17 S01A

How do deicer boots help remove ice accumulations?

- A — By allowing only a thin layer of ice to build up.
- B — By preventing the formation of ice.
- C — By breaking up ice formations.

Answer C. JSAT 13-8 (AC65-15A)

The deicing boots of a pneumatic system are composed of a series of inflatable tubes. During operation, the tubes are inflated with pressurized air, and deflated in an alternating cycle. This inflation and deflation causes the ice to crack and break off.

13A-18 S01A

Why are the tubes in deicer boots alternately inflated?

- A — Alternate inflation of deicer boot tubes does not disturb airflow.
- B — Alternate inflation of deicer boot tubes keeps disturbance of the airflow to a minimum.
- C — Alternate inflation of deicer boot tubes relieves the load on the air pump.

Answer B. JSAT 13-8 (AC65-15A)

Deicer boots are installed in sections along the wing with the different sections operating alternately and symmetrically about the fuselage. This is done so that any disturbance to airflow caused by an inflated tube will be kept to a minimum by inflating only short sections on each wing at a time.

13A-19 S01A

Carburetor icing may be eliminated by which of the following methods?

- A — Ethylene glycol spray and heated induction air.
- B — Electrically heating air intake, ethylene glycol spray, or alcohol spray.
- C — Alcohol spray and heated induction air.

Answer C. JSPT 5-5 (AC65-15A)

Carburetor icing may be eliminated by heating the induction air or by using an alcohol spray. The most common method in use today is heating of the induction air.

13A-20 S01A

What mixture may be used as a deicing fluid to remove frost from an aircraft surface?

- A — Methyl ethyl ketone and ethylene glycol.
- B — Ethylene glycol and isopropyl alcohol.
- C — Naphtha and isopropyl alcohol.

Answer B. JSAT 13-15 (AC65-15A)

A mixture of ethylene glycol and isopropyl alcohol is used for aircraft deicing.

13A-21 S01A

Which of the following is the best means to use when removing wet snow from an aircraft?

- A — Hot air.
- B — Warm water.
- C — A brush or a squeegee.

Answer C. JSAT 13-15 (AC65-15A)

Wet snow should be removed with a brush or a squeegee.

13A-22 S01A

What are three methods of anti icing aircraft windshields?

1. Blanket type heating system.
2. An electric heating element in the windshield.
3. Heated air circulating system.
4. Hot water system.
5. Windshield wipers and anti icing fluid.
6. Ribbon type heating system.

A — 2, 3, and 4.

B — 2, 3, and 5.

C — 1, 2, and 6.

Answer B. (AC65-15A)

Windshield wipers, circulated hot air and electric elements can be used as methods of anti-icing an aircraft windshield.

13A-23 S01A

What icing condition may occur when there is no visible moisture present?

A — Injector ice.

B — Carburetor ice.

C — Inlet ice.

Answer B. JSAT 13-2 (AC65-15A)

Ice may be expected to form whenever there is visible moisture in the air and the temperature is near or below freezing. An exception is carburetor icing which can occur during warm weather with no visible moisture present.

13A-24 S01A

What should be used to melt the ice in a turbine engine if the compressor is immobile because of ice?

A — Anti icing fluid.

B — Deicing fluid.

C — Hot air.

Answer C. (AC65-15A)

If the compressor cannot be turned by hand because of the pressure of ice or snow, hot air should be blown through the engine until the rotating parts are free.

13A-25 S01A

What is used as a temperature sensing element in an electrically heated windshield?

A — Thermometer.

B — Thermistor.

C — Thermocouple.

Answer B. JSAT 13-6 (AC65-15A)

The temperature sensing element in an electrically heated windshield is a thermistor.

SECTION B RAIN CONTROL SYSTEMS

Section B of Chapter 13 contains information regarding windshield rain repellent systems.

13B-1 S01A

Why should a chemical rain repellent not be used on a dry windshield?

- A — It will cause glass crazing.
- B — It will etch the glass.
- C — It will restrict visibility.

Answer C. JSAT 13-18 (AC65-15A)

The rain repellent system should not be operated on dry windows because heavy undiluted repellent will restrict window visibility. Should the system be operated inadvertently, do not operate the windshield wipers or rain clearing system as this tends to increase the smearing.

13B-2 S01A

What is the principle of a windshield pneumatic rain removal system?

- A — An air blast spreads a liquid rain repellent evenly over the windshield that prevents raindrops from clinging to the glass surface.
- B — A pneumatic rain removal system is simply a mechanical windshield wiper system that is powered by pneumatic system pressure.
- C — An air blast forms a barrier that prevents raindrops from striking the windshield surface.

Answer C. JSAT 13-18 (AC65-15A)

With the advent of turbine powered aircraft, the pneumatic rain removal system became feasible. This method uses high pressure, high temperature engine compressor bleed air which is blown across the windshields. This air blast forms a barrier that prevents raindrops from striking the windshield surface.

CABIN ATMOSPHERE CONTROL SYSTEMS

SECTION A FLIGHT PHYSIOLOGY

Section A of Chapter 14 contains information related to physiological factors related to aviation activities, including hypoxia, hyperventilation, and carbon monoxide poisoning. This information is important for understanding the operating requirements for cabin atmosphere control systems. however, there are no FAA Airman Knowledge Exam questions for this subject.

SECTION B OXYGEN AND PRESSURIZATION SYSTEMS

Section B of Chapter 14 contains information regarding cabin pressurization and supplemental breathing oxygen systems.

14B-1 M01A

Which section of a turbine engine provides high pressure bleed air to an air cycle machine for pressurization and air-conditioning?

- A — C-D inlet compressor duct.
- B — Inlet compressor.
- C — Turbine compressor.

Answer C. JSAT 14-20 (AC65- 15A)

With gas turbine engines, the cabin can be pressurized by bleeding air from the engine compressor. Usually the air bled from an engine compressor is sufficiently free from contamination and can be used safely for cabin pressurization.

14B-2 M01A

The cabin pressure of an aircraft in flight is maintained at the selected altitude by

- A — controlling the air inflow rate.
- B — controlling the rate at which air leaves the cabin.
- C — inflating door seals and recirculating conditioned cabin air.

Answer B. JSAT 14-22

Cabin pressurization is obtained by flowing more air than is needed into the cabin, and controlling the exhaust of excess air.

14B-3 M01A

What controls the operation of the cabin pressure regulator?

- A — Cabin altitude.
- B — Bleed air pressure.
- C — Compression air pressure.

Answer A. JSAT 14-22 (AC65-15A)

What the cabin pressure regulator does, and how it controls the outflow valve, is determined by cabin air pressure.

14B-4 M01A

The purpose of the dump valve in a pressurized aircraft is to relieve

- A — a negative pressure differential.
- B — pressure in excess of the maximum differential.
- C — all positive pressure from the cabin.

Answer C. JSAT 14-22 (AC65-15A)

A dump valve in a pressurization system might be operated by a switch in the cockpit. The purpose of the dump valve is to release the cabin air pressure to atmosphere.

14B-5 M01A

What test is used to determine the serviceability of an oxygen cylinder?

- A — Pressure test with water.
- B — Pressure test with nitrogen.
- C — Pressure test with manometer.

Answer A. JSAT 14-8

Oxygen cylinders must be hydrostatically tested to 5/3 of their working pressure by testing with water pressure.

14B-6 M01A

How often should standard weight high pressure oxygen cylinders be hydrostatically tested?

- A — Every 4 years.
- B — Every 3 years.
- C — Every 5 years.

Answer C. JSAT 14-8

Standard weight cylinders are marked DOT 3AA and must be hydrostatically tested every 5 years.

14B-7 M01A

To be eligible for recharging, a DOT 3HT oxygen cylinder must have been hydrostatically tested every three years and be retired from service after

- A — 15 years or 10 000 filling cycles.
- B — 24 years or 4380 filling cycles.
- C — 10 years or 5000 filling cycles.

Answer B. JSAT 14-8

DOT 3HT oxygen cylinders must be hydrostatically tested every three years and taken out of service after 24 years or after having been filled 4,380 times, whichever occurs first.

14B-8 M01A

What type of oxygen system uses the rebreather bag-type mask?

- A — Demand.
- B — Diluter demand.
- C — Continuous flow.

Answer C. JSAT 14-11

Almost all of the masks used with a continuous flow oxygen system are of the rebreather type.

14B-9 M01A

The altitude controller maintains cabin altitude by modulation of the

- A — outflow valve.
- B — safety valve.
- C — safety and outflow valves.

Answer A. JSAT 14-22 (AC65-15A)

The outflow valve is opened and closed by the altitude controller to maintain the desired cabin altitude.

14B-10 M01A

For use in pressurized aircraft, which is generally the least complicated and requires the least maintenance?

- A — High-pressure oxygen systems.
- B — Low-pressure oxygen systems.
- C — Chemical oxygen generator systems.

Answer C. JSAT 14-7 (AC65-15A)

The solid state chemical oxygen generator is the most efficient system space-wise, also less equipment and maintenance is required.

14B-11 M01A

The main cause of contamination in gaseous oxygen systems is

- A — moisture.
- B — dust and other airborne particulates.
- C — other atmospheric gases.

Answer A. JSAT 14-6 (AC65-15A)

The main cause of contamination in the system is moisture.

14B-12 M01A

How is the cabin pressure of a pressurized aircraft usually controlled?

- A — By an automatic outflow valve that dumps all the pressure in excess of the amount for which it is set.
- B — By a pressure sensitive valve that controls the output pressure of the pressurization pump.
- C — By a pressure sensitive switch that causes the pressurization pump to turn on or off as required.

Answer A. JSAT 14-22 (AC65-15A)

Cabin pressurization is usually controlled by a cabin pressure regulator which opens or closes an outflow valve. The opening or closing of the outflow valve maintains the right amount of pressure in the aircraft, according to what is set on the pressurization controller.

14B-13 M01A

On some cabin pressurization systems, pressurization on the ground is restricted by the

- A — main landing gear operated switch.
- B — negative pressure-relief valve.
- C — cabin pressure regulator.

Answer A. JSAT 14-22

The safety and outflow valves are held in the open position when the weight of the airplane is on the main gear.

14B-14 M01A

The cabin pressure control setting has a direct influence upon the

- A — outflow valve opening.
- B — pneumatic system pressure.
- C — inflow valve opening.

Answer A. JSAT 14-22 (AC65-15A)

When the cabin pressurization controller is set for a desired cabin altitude, one of the system components which is affected is the outflow valve. How much the outflow valve will be open, if it is open at all, will be determined by the cabin altitude which is set.

14B-15 M01A

What component of a pressurization system prevents the cabin altitude from becoming higher than airplane altitude?

- A — Negative pressure relief valve.
- B — Cabin rate of descent control.
- C — Positive pressure relief valve.

Answer A. JSAT 14-24 (AC65-15A)

All pressurized aircraft require some form of a negative pressure relief valve. This valve opens when outside air pressure is greater than cabin pressure. The negative pressure relief valve prevents accidentally obtaining a cabin altitude which is higher than the aircraft altitude.

14B-16 M01A

If the cabin rate of climb is too great, the control should be adjusted to cause the

- A — cabin compressor speed to decrease.
- B — outflow valve to close slower.
- C — outflow valve to close faster.

Answer C. JSAT 14-22 (AC65-15A)

The closing of the outflow valve in a pressurization system causes the cabin to pressurize quicker. If the cabin pressure altitude is not being maintained as the aircraft climbs to higher altitudes, the outflow valve controller needs to be adjusted so the outflow valve will close faster.

14B-17 M01A

Which prevents a sudden loss of pressurization in the event that there is a loss of the pressurization source?

- A — Firewall shutoff valve.
- B — Cabin pressure outflow valve.
- C — Delivery air duct check valve.

Answer C. JSAT 14-24 (AC65-15A)

After leaving the cabin air compressor, pressurized air passes through a combination check valve/shutoff valve on its way to the delivery air ducts. This check valve prevents the air pressure from being lost through an inoperative compressor.

14B-18 M01A

The primary function of the cabin pressurization system outflow valve is to

- A — maintain the same cabin air pressure at all altitudes.
- B — maintain the desired cabin pressure.
- C — provide protection against over pressurization.

Answer B. JSAT 14-22 (AC65-15A)

The principal control of the pressurization system is the outflow valve. It is regulated by the altitude controller.

14B-19 M01A

One purpose of a jet pump in a pressurization and air conditioning system is to

- A — produce a high pressure for operation of the outflow valve.
- B — provide for augmentation of airflow in some areas of the aircraft.
- C — assist in the circulation of Freon.

Answer B. JSAT 14-21

A jet pump uses a venturi to augment airflow into an aircraft for cabin pressurization. Compressor bleed air is directed through a jet pump venturi, which creates a low pressure area in the throat of the venturi due to the bleed air's high velocity. This low pressure area draws in outside air, which mixes with the compressor bleed air. From there, the mixed air flows into the environmental distribution system where the pressurized air is routed to different areas of the aircraft.

14B-20 M01A

An aircraft pressurization cycle is normally considered to be

- A — one take off and one landing.
- B — when the fuselage reaches its maximum pressure differential one time.
- C — one complete series of events or operations that recur regularly.

Answer C. (AC65-15A)

When an aircraft is pressurized, it is subjected to a force acting from within which is greater than the force acting from the outside, namely atmospheric pressure. Tension is a primary stress on aircraft that tries to pull an aircraft apart, or stretch a structural member; it is this tensile stress that an aircraft experiences when, under a condition of pressurization, the aircraft tries to force itself apart. One of the problems in designing pressurized aircraft is selecting the proper structural materials which will be able to withstand the great differential in pressure that exists between the inside and outside of a pressurized aircraft.

14B-21 M01A

Which best describes cabin differential pressure?

- A — Difference between the ambient and internal air pressure.
- B — Difference between cabin pressure controller setting and actual cabin pressure.
- C — Difference between cabin flight altitude pressure and Mean Sea Level pressure.

Answer A. JSAT 14-20 (AC65-15A)

Differential pressure is the difference in pressure between the pressure acting on one side of a wall and the pressure acting on the other side of the wall. In aircraft air conditioning and pressurizing systems, it is the difference between cabin pressure and atmospheric pressure.

14B-22 M01A

Composite oxygen bottles that conform to DOT-E-8162 have a service life of

- A — 10 years or 5000 filling cycles whichever occurs first.
- B — 5 years or 5000 filling cycles whichever occurs first.
- C — 15 years or 10 000 filling cycles whichever occurs first.

Answer C. JSAT 14-8 (AC65-15A)

E-8162 cylinders are tested to the same standards as 3HT cylinders, but are removed from service after 15 years or 10,000 filling cycles.

14B-23 M01A

The cabin pressurization modes of operation are

- A — ambient, unpressurized, and isobaric.
- B — differential, unpressurized, and isobaric.
- C — isobaric, differential, and maximum differential.

Answer B. JSAT 14-20 (AC65-15A)

By regulating the reference chamber air pressure in the cabin air pressure regulator, the isobaric and differential control systems control the actions of the outflow valve. By controlling the outflow valve, which allows pressurized air to escape to atmosphere or keeps it in the aircraft, the system provides for three modes of operation called unpressurized, isobaric, and differential.

14B-24 M01A

- (1) Usually bleed air from a gas-turbine engine compressor can be safely used for cabin pressurization.
- (2) Independent cabin condition air machines (air cycle machine) can be powered by bleed air from an aircraft turbine engine compressor.

Regarding the above statements,

- A — only No. 1 is true.
B — both No. 1 and No. 2 are true.
C — only No. 2 is true.

Answer B. JSAT 14-20 (AC65-15A)

With aircraft powered by gas turbine engines, the aircraft cabin can be pressurized by bleeding air from the engine's compressor. Usually the air bled from an engine compressor is sufficiently free from contamination and can be used safely for cabin pressurization. This source of air for pressurization is not always the best way to go, however. Another method of obtaining pressurized air is the use of independent cabin compressors. These compressors can be engine driven through the accessory drive gearing, or can be powered by bleed air from a gas turbine engine.

14B-25 M01A

A pressurization controller uses

- A — barometric pressure, cabin altitude, and cabin rate of change.
B — bleed air pressure, outside air temperature, and cabin rate of climb.
C — cabin rate of climb, bleed air volume, and cabin pressure.

Answer A. JSAT 14-22 (AC65-15A)

A pressurization controller looks very much like an altimeter with several added adjustment knobs. Usually there is one adjustment knob for setting the desired cabin altitude. There is a separate knob for setting the existing altimeter setting or sea level barometric pressure. There is a third knob on the controller which adjusts the cabin rate of altitude change.

14B-26 M01A

Which is considered a good practice concerning the inspection of heating and exhaust systems of aircraft utilizing a jacket around the engine exhaust as a heat source?

- A — Supplement physical inspections with periodic operational carbon monoxide detection tests.
B — All exhaust system components should be removed periodically, and their condition determined by the magnetic particle inspection method.
C — All exhaust system components should be removed and replaced at each 100-hour inspection period.

Answer A. JSAT 14-5

One of the biggest dangers of an aircraft heating system that uses a jacket around the engine exhaust system is the possibility of carbon monoxide being introduced into the cabin. As well as visual inspections of the system, it should be periodically checked for carbon monoxide leakage.

14B-27 M02A

When an aircraft's oxygen system has developed a leak, the lines and fittings should be

- A — removed and replaced.
B — bubble tested with a special soap solution manufactured specifically for this purpose.
C — inspected using a special oxygen system dye penetrant.

Answer B. JSAT 14-16

Leaks in an oxygen system should be searched out using a special non-oily soap solution.

14B-28 M02A

If oxygen bottle pressure is allowed to drop below a specified minimum, it may cause

- A — moisture to collect in the bottle.
- B — the pressure reducer to fail.
- C — the automatic altitude control valve to open.

Answer A. JSAT 14-17 (AC65-15A)

One of the precautions to exercise when draining an oxygen system is not to drain it too rapidly, because this will cause condensation within the system. The same problem can be caused by allowing the bottle pressure to drop below a specified minimum.

14B-29 M02A

What controls the amount of oxygen delivered to a mask in a continuous flow oxygen system?

- A — Calibrated orifice.
- B — Pilot's regulator.
- C — Pressure reducing valve.

Answer A. (AC65-15A)

In a continuous flow system, oxygen flows from the charged cylinder through the high pressure line to the pressure-reducing valve, which reduces the pressure to that required at the mask outlets. A calibrated orifice in the outlets will control the amount of oxygen delivered to the mask.

14B-30 M02A

In the diluter demand oxygen regulator, when does the demand valve operate?

- A — When the user breathes.
- B — When the user demands 100 percent oxygen.
- C — When the diluter control is set at normal.

Answer A. JSAT 14-11 (AC65-15A)

The essential feature of a diluter-demand regulator is a diaphragm-operated valve called the demand valve, which opens by slight suction on the diaphragm during inhalation, and which closes during exhalation.

14B-31 M02A

The primary difference between aviation breathing oxygen and other types of commercially available compressed oxygen is that

- A — aviation breathing oxygen has had all the water vapor removed.
- B — the other types are usually somewhat less than 99.5 percent pure oxygen.
- C — aviation breathing oxygen has a higher percentage of water vapor to help prevent drying of a person's breathing passages and possible dehydration.

Answer A. JSAT 14-7 (AC65-15A)

Commercial oxygen is used in great quantities for welding and cutting, and for medical use in hospitals and ambulances. Aviators' breathing oxygen is similar to that used for commercial purposes, except that it is additionally processed to remove almost all of the water that could freeze and stop the flow of oxygen.

14B-32 M02A

What is used in some oxygen systems to change high cylinder pressure to low system pressure?

- A — Pressure reducer valve.
- B — Calibrated fixed orifice.
- C — Diluter demand regulator.

Answer A. JSAT 14-8 (AC65-15A)

In high-pressure oxygen systems, pressure reducer valves are usually located at the inlet of the regulator. These valves decrease the pressure to a value that is usable by the regulator.

14B-33 M02A

In a high-pressure oxygen system, if the pressure reducer fails, what prevents high pressure oxygen from entering the system downstream?

- A — Manifold control valve.
- B — Check valve.
- C — Pressure relief valve.

Answer C. JSAT 14-8 (AC65-15A)

A pressure-relief valve is incorporated in the main supply line of a high-pressure system. The relief valve prevents high-pressure oxygen from entering the system downstream of the pressure reducer if the pressure reducer fails.

14B-34 M02A

High pressure cylinders containing oxygen for aviation use can be identified by their

- A — green color and the words “AVIATOR’S BREATHING OXYGEN” stenciled in 1-inch white letters.
- B — yellow color and the words “AVIATOR’S BREATHING OXYGEN” stenciled in 1-inch white letters.
- C — green color and the words “BREATHING OXYGEN” stenciled in 1-inch white letters.

Answer A. JSAT 14-8 (AC65-15A)

Oxygen cylinders for aviation use are identified by their dark green color and the words “Aviators’ Breathing Oxygen” stenciled in white letters along the cylinder.

14B-35 M02A

An aircraft oxygen bottle may be considered air-worthy if it has been hydrostatically tested and identified

- A — with the DOT number and manufacturer stamped on the cylinder near the neck.
- B — with the DOT number, serial number and manufacturer stamped on the cylinder near the neck.
- C — with the test date, DOT number and serial number stamped on the cylinder near the neck.

Answer C. JSAT 14-8 (AC65-15A)

After hydrostatic testing, the test date and DOT number of the testing station are stamped on the neck of the bottle along with the serial number of the bottle.

14B-36 M02A

In a gaseous oxygen system, which of the following are vented to blow out plugs in the fuselage skin?

- A — Filler shutoff valves.
- B — Pressure relief valves.
- C — Pressure reducer valves.

Answer B. JSAT 14-8 (AC65-15A)

A pressure-relief valve is incorporated in the main supply line of a high-pressure system. The relief valve is vented to a blowout plug in the fuselage skin.

14B-37 M02A

The purpose of pressurizing aircraft cabins is to

- (1) create the proper environment for prevention of hypoxia.
- (2) permit operation at high altitudes.

Regarding the above statements,

- A — both No. 1 and No. 2 are true.
- B — only No. 2 is true.
- C — only No. 1 is true.

Answer A. JSAT 14-19 (AC65-15A)

There are many economic and creature comfort advantages of being able to operate an aircraft at high altitude. High altitude flight means operating above the weather and the majority of the turbulence. To operate at high altitude, however, requires that the cabin be pressurized so the occupants of the aircraft do not suffer from hypoxia.

14B-38 M02A

- (1) Oxygen used in aircraft systems is at least 99.5 percent pure and is practically water free.
- (2) Oxygen used in aircraft systems is 99.5 percent pure and is hospital quality.

Regarding the above statements,

- A — both No. 1 and No. 2 are true.
- B — only No. 1 is true.
- C — neither No. 1 nor No. 2 is true.

Answer B. JSAT 14-6 (AC65-15A)

Gaseous breathing oxygen used in aircraft is a special type of oxygen containing practically no water vapor, and is at least 99.5% pure. While other types of oxygen (welder, hospital) may be pure enough, they usually contain water, which might freeze and block the oxygen system plumbing.

14B-39 M02A

Oxygen systems in unpressurized aircraft are generally of the

- A — pressure demand type only.
- B — continuous flow and pressure demand types.
- C — portable bottle type only.

Answer B. JSAT 14-9 (AC65-15A)

In some aircraft a continuous-flow oxygen system is installed for both passengers and crew. The pressure demand system is widely used as a crew system, especially on the larger transport aircraft. Many aircraft have a combination of both systems which may be augmented by portable equipment.

14B-40 M02A

The purpose of the airflow metering aneroid assembly found in oxygen diluter demand regulators is to

- A — automatically put the regulator in emergency position if the demand valve diaphragm ruptures.
- B — regulate airflow in relation to cabin altitude when in diluter demand position.
- C — regulate airflow in relation to oxygen flow when operating in emergency or diluter demand positions.

Answer B. JSAT 14-10 (AC65-15A)

The purpose of the airflow metering aneroid assembly found in an oxygen diluter demand regulator is to meter the amount of air which will be mixed with oxygen as the aircraft climbs to altitude. As the altitude of the aircraft increases, the amount of oxygen supplied increases, and the air supplied decreases. At approximately 34,000 ft., 100% oxygen is being supplied. The diluter demand position referred to in the answer is better called the normal oxygen position.

14B-41 M02A

If a high pressure oxygen cylinder is to be installed in an airplane, it must meet the specifications of the

- A — aircraft manufacturer or the cylinder manufacturer.
- B — National Transportation Safety Board or the Standards of Compressed Gas Cylinders.
- C — Department of Transportation.

Answer C. JSAT 14-8

Today, almost all gaseous oxygen is stored in green painted steel cylinders. All cylinders approved for installation in an aircraft must be approved by the Department of Transportation.

14B-42 M02A

Before a high pressure oxygen cylinder is serviced, it must be the correct type and have been

- A — hydrostatically tested within the proper time interval.
- B — approved by the National Transportation Safety Board.
- C — inspected by a certificated airframe mechanic.

Answer A. JSAT 14-8

Before filling any aircraft system, the technician must be sure that all of the cylinders are of the approved type, and that they have all been hydrostatically tested within the required time interval.

14B-43 M02A

A contaminated oxygen system is normally purged with

- A — compressed air.
- B — nitrogen.
- C — oxygen.

Answer C. JSAT 14-18

If an oxygen system has been opened for servicing, it should be purged of any air that may be in the lines. To purge a continuous-flow system, plug masks into each of the outlets, turn on the oxygen supply valve, and allow the oxygen to flow through the system for about ten minutes.

14B-44 M02A

How should you determine the amount of oxygen in a portable, high pressure cylinder?

- A — Read the pressure gauge mounted on the cylinder.
- B — Measure the pressure at the mask.
- C — Weigh the cylinder and its contents.

Answer A. JSAT 14-17

A combination shutoff, regulator, and fill valve is usually mounted on the side of a portable high-pressure oxygen cylinder, and usually a pressure gage. This gage indicates the amount of oxygen in the cylinder because the quantity is related to the pressure in the container.

14B-45 M02A

What may be used as a lubricant on oxygen system tapered pipe thread connections?

- A — Glycerin.
- B — Teflon tape.
- C — Silicone dielectric compound.

Answer B. JSAT 14-19

Oxygen compatible thread lube that meets MIL-T-5542 or Teflon® tape are all that is recommended.

14B-46 M02A

On transport category aircraft what might be an indication of an over pressure event of the aircraft oxygen system?

- A — The green thermal expansion disk in the cockpit missing.
- B — The green thermal expansion disk on the oxygen regulator missing.
- C — The green thermal expansion disk missing.

Answer C. JSAT 14-8

Relief valves are located in the lines between the cylinders and the regulators. When an over pressure is encountered, a green thermal expansion disk on the side of the fuselage is blown out of its mounting.

14B-47 M02A

Which of the following are characteristic of a chemical or solid state oxygen system?

1. An adjustable oxygen release rate.
2. A volume storage capacity about three times that of compressed oxygen.
3. The system generators are inert below 400°F even under severe impact.
4. A distribution and regulating system similar to gaseous oxygen systems.

A — 2 and 3.

B — 1 and 2.

C — 3 and 4

Answer A. JSAT 14-14 (AC65-15A)

A solid state oxygen system utilizes a chemical oxygen "candle" that releases oxygen at a programmed rate. The size and simplicity of the units, and minimal maintenance requirements make them ideal for many applications. The chemical oxygen generator requires 1/3 of the volume requirements as for an equivalent Oxygen bottle supplying an equal amount of oxygen. The canisters are inert below 400°F. Even under the severest impact.

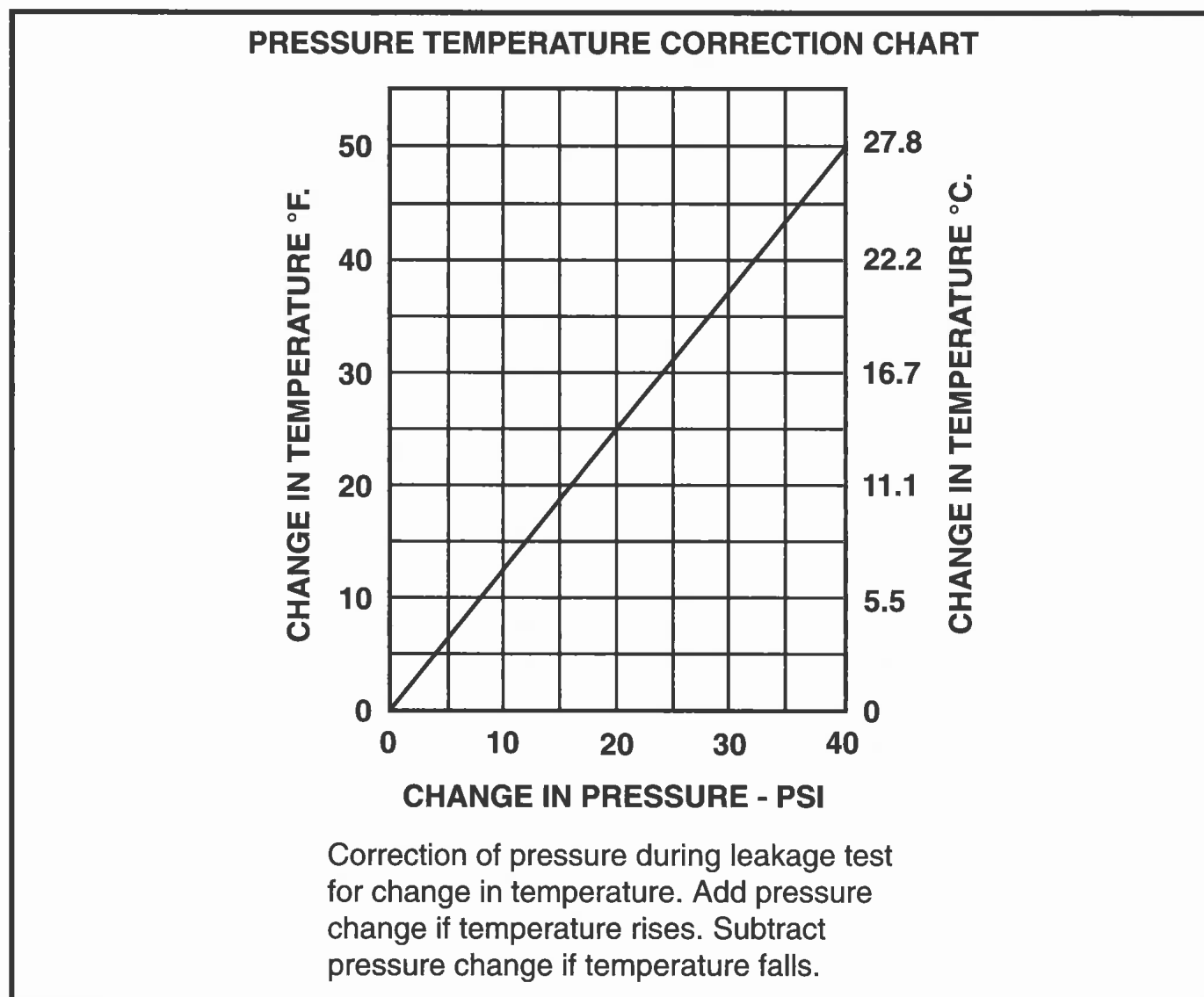


Figure 14. — Pressure Temperature Correction Chart

14B-48 M02A

(Refer to Airframe figure 14) One hour after an oxygen system was charged for a leakage check, the oxygen pressure gauge read 460 PSI at 63°F; 6 hours later the temperature was 51°F. (A 5 PSI change is the maximum allowable in a 6-hour period.) What pressure gauge readings would be acceptable to remain within the allowable limits?

- A — 445 to 450 PSI.
- B — 446 to 450 PSI.
- C — 455 to 460 PSI.

Answer A. JSAT 14-18 (AC65-15A)

First determine what the pressure gauge would read if there were no leakage. Because the temperature has gone down 12°, the gauge will read differently. The chart supplied may be used to determine

the gauge reading. Locate the 12° change in temperature on the left side of the chart. Project a line horizontally across the chart to intersect with the diagonal line. From that point drop a vertical line to the bottom of the chart and read the change in pressure due to the change in temperature. This change is about 10 PSI. The instructions on the bottom of the chart tell you to subtract the pressure change value, if the temperature falls. 460 PSI minus 10 PSI gives a gauge reading of 450 PSI. Because a 5 PSI change is allowable, the gauge reading must be between 445 and 450 PSI to remain within the allowable limits.

SECTION C

CABIN CLIMATE CONTROL SYSTEMS

Section C of Chapter 14 contains information regarding aircraft interior cooling, heating, and climate control devices.

14C-1 M01A

At which component in an air cycle cooling system does air undergo a pressure and temperature drop?

- A — Expansion turbine.
- B — Primary heat exchanger.
- C — Refrigeration bypass valve.

Answer A. JSAT 14-32 (AC65-15A)

An air cycle cooling system consists of an expansion turbine (cooling turbine), an air-to-air heat exchanger, and various valves which control airflow through the system. High pressure air from the cabin compressor is routed through the turbine section. As the air passes through the turbine, it rotates the turbine and the impeller. When the compressed air performs the work of turning the turbine, it undergoes a pressure and temperature drop.

14C-2 M01A

In a freon vapor cycle cooling system, where is cooling air obtained for the condenser?

- A — Pressurized cabin air.
- B — Turbine engine compressor.
- C — Ambient air.

Answer C. JSAT 14-39 (AC65-15A)

When the Freon® gas leaves the compressor in a vapor-cycle air conditioning system, it flows to the condenser. At the condenser, the gas passes through a heat exchanger where outside (ambient) air removes heat from the Freon®. When the heat is removed from the Freon® gas, the gas changes to a liquid and a great amount of heat is given up.

14C-3 M01A

What is ventilating air used for on a combustion heater?

- A — Provides air required to support the flame.
- B — Carries heat to the places where needed.
- C — Provides combustion air for ground blower.

Answer B. JSAT 14-28 (AC65-15A)

Regardless of size, every combustion heater needs four things for operation: (1) Fuel to burn; (2) Ignition to ignite the fuel; (3) Combustion air to provide the oxygen required to support the flame; and (4) Ventilating air to carry the heat to the places where it is needed.

14C-4 M01A

Turbine engine air used for air conditioning and pressurization is generally called

- A — ram air.
- B — compressed air.
- C — bleed air.

Answer C. JSAT 14-30 (AC65-15A)

When gas turbine engines are involved in the cabin pressurization process, the air is usually bled from the engine's compressor. This air is generally referred to as bleed air.

14C-5 M01A

In the combustion heater, combustion air system, what prevents too much air from entering the heaters as air pressure increases?

- A — Only a differential pressure regulator can be used.
- B — Either a combustion air relief valve or a differential pressure regulator.
- C — Only a combustion air relief valve can be used.

Answer B. JSAT 14-29 (AC65-15A)

To prevent too much air from entering the heaters as air pressure increases, either a combustion air relief valve or a differential pressure regulator is provided.

14C-6 M01A

The basic air cycle cooling system consists of

- A — heaters, coolers, and compressors.
- B — a source of compressed air, heat exchangers, and a turbine.
- C — ram air source, compressors, and engine bleeds.

Answer B. JSAT 14-30 (AC65-15A)

An air cycle cooling system consists of an expansion turbine (cooling turbine), an air-to-air heat exchanger, various valves to control airflow, and a source of high pressure air.

14C-7 M01A

What component might possibly be damaged if liquid refrigerant is introduced into the low side of a vapor cycle cooling system when the pressure is too high or the outside air temperature is too low?

- A — Compressor.
- B — Condenser.
- C — Evaporator.

Answer A. JSAT 14-47

When servicing a vapor cycle system with Freon®, the Freon® can should be held upright so vapor will come out and not liquid Freon®. If the low-side pressure is below 40 PSIG, the can may be inverted and liquid allowed to enter the system because the liquid will turn into a vapor before it enters the compressor at this low pressure. If the air temperature is below 80°F, the can should never be inverted, because at low temperatures the liquid may not all vaporize. If liquid Freon® is allowed to enter the compressor it will damage the unit.

14C-8 M01A

How can it be determined that a vapor cycle cooling system is charged with the proper amount of Freon®?

- A — The compressor loads up and RPM decreases.
- B — Air bubbles appear in the sight glass.
- C — Air bubbles in the sight glass disappear.

Answer C. JSAT 14-36 (AC65-15A)

When charging a vapor cycle system with Freon®, the technician should service with as many pounds of refrigerant as the specifications call for. A full charge will be indicated by the absence of bubbles in the sight glass of the receiver-dryer.

14C-9 M01A

When charging a vapor cycle cooling system after evacuation, the low pressure gauge fails to come out of a vacuum. What is indicated?

- A — The expansion valve failed to close.
- B — Blockage in the system.
- C — The compressor is not engaging.

Answer B. JSAT 14-46

When servicing a vapor cycle system with Freon® after the system has been evacuated, the high-side valve should be opened and the low-side valve watched to see that it starts to come out of a vacuum. If the low-side valve does not come out of a vacuum, it indicates that there is a blockage in the system and that the charge is not being taken.

14C-10 M01A

What component in a vapor cycle cooling system would most likely be at fault if a system would not take a freon charge?

- A — Expansion valve.
- B — Condenser.
- C — Receiver dryer.

Answer A. JSAT 14-36 (AC65-15A)

The most likely culprit if a vapor cycle system will not take a charge is the expansion valve. With just a few drops of moisture in the system, the expansion valve will freeze up due to the extremely cold temperature it operates under.

14C-11 M01A

Frost or ice buildup on a vapor cycle cooling system evaporator would most likely be caused by

- A — moisture in the evaporator.
- B — the mixing valve sticking closed.
- C — inadequate airflow through the evaporator.

Answer C. JSAT 14-44

Evaporator fins should be checked to be sure they are clean and free of any obstruction. If the air over the evaporator should ever be obstructed, the fins will ice up.

14C-12 M01A

Hot compressor bleed air operates the conditioned air system on some turbine aircraft, how is cold air supplied?

- A — By the ram cycle cooling unit.
- B — By the flow control unit.
- C — By the air cycle machine turbine.

Answer C. JSAT 14-32 (AC65-15A)

The majority of heat is removed from the air when it flows into the expansion turbine of the air cycle machine.

14C-13 M01A

Where does the last stage of cooling in an air cycle air conditioning system occur?

- A — Secondary heat exchanger.
- B — Refrigeration unit compressor.
- C — Expansion turbine.

Answer C. JSAT 14-32 (AC65-15A)

As the cabin air leaves the secondary heat exchanger, it is routed to the expansion turbine, which is rotated by the air pressure on it. In performing this function, it is further cooled before entering the water separator, then routed to the cabin.

14C-14 M01A

The point at which Freon® flowing through a vapor cycle cooling system gives up heat and changes from a gas to a liquid is the

- A — expansion valve.
- B — evaporator.
- C — condenser.

Answer C. JSAT 14-39 (AC65-15A)

The refrigerant at a high temperature and pressure flows into the condenser. Here heat flows from the refrigerant to the outside air, condensing the vapor into a liquid.

14C-15 M01A

The point at which Freon® flowing through a vapor cycle cooling system absorbs heat and changes from a liquid to a gas is the

- A — condenser.
- B — expansion valve.
- C — evaporator.

Answer C. JSAT 14-37 (AC65-15A)

The Freon® changes from a liquid to a vapor at the evaporator. The evaporator is designed so that heat is taken from the cabin air.

14C-16 M01A

The function of the evaporator in a Freon® cooling system is to

- A — lower the temperature of the cabin air.
- B — transfer heat from the freon gas to ambient air.
- C — liquefy freon in the line between the compressor and the condenser.

Answer A. JSAT 14-37 (AC65-15A)

The purpose of the evaporator in a Freon® cooling system is to cool the air which flows through it. Freon® in the evaporator changes from a liquid to a gaseous state, and in so doing absorbs large quantities of heat from the air passing through it.

14C-17 M01A

What is the purpose of a mixing valve in a compressor bleed air air-conditioning system?

- A — Distribute conditioned air evenly to all parts of the cabin.
- B — Combine ram air with conditioned air.
- C — Control the supply of hot, cool, and cold air.

Answer C. JSAT 14-30 (AC65-15A)

A cabin air temperature control regulator, in conjunction with the air temperature selector rheostat and the air duct temperature pickup unit, automatically maintains the temperature of the air entering the cabin at a preselected value. These controls cause a mixing valve to operate, which mixes the proper amounts of cool and hot air to achieve the desired temperature.

14C-18 M01A

If the liquid level gauge in a vapor cycle cooling system indicates a low Freon® charge, the system should

- A — be operated and a pressure check performed.
- B — not be operated until freon and oil have been added.
- C — be operated for a period of time to reach a stable condition and then the freon level rechecked.

Answer C. (AC65-15A)

To check the Freon® level in a vapor cycle system, it is necessary to operate the refrigeration unit for approximately 5 minutes to reach a stable condition. If the system uses a sight glass, the flow of Freon® through the sight glass should be observed. If the Freon® charge is low, bubbles will appear in the sight glass.

14C-19 M01A

The position of the thermostatic expansion valve in a vapor cycle cooling system is determined by temperature and pressure of the

- A — Freon® entering the evaporator.
- B — Freon® in the outlet of the evaporator.
- C — air in the outlet of the condenser.

Answer B. JSAT 14-36 (AC65-15A)

By sensing the temperature and the pressure of the Freon® gas leaving the evaporator, the expansion valve meters the right amount of gas to preclude the possibility of the evaporator becoming flooded and returning liquid refrigerant to the compressor.

14C-20 M01A

The function of the condenser in a Freon® cooling system is to

- A — transfer heat from the Freon® gas to ambient air.
- B — change liquid Freon® into a gas before it enters the compressor.
- C — transfer heat from the cabin air to the liquid Freon®.

Answer A. JSAT 14-39 (AC65-15A)

The condenser is the radiator-like component which receives the hot, high-pressure vapors from the compressor and allows cool air to flow over its coils and remove the heat from the Freon®. The condenser cools the Freon® down and turns it back into a liquid.

14C-21 M01A

The function of an expansion valve in a Freon® cooling system is to act as a metering device and to

- A — reduce the pressure of the gaseous Freon®.
- B — increase the pressure of the liquid Freon®.
- C — reduce the pressure of the liquid Freon®.

Answer C. JSAT 14-36 (AC65-15A)

The Freon® coming out of the condenser is high-pressure liquid refrigerant. The expansion valve lowers the Freon® pressure and thus lowers the temperature.

14C-22 M01A

When servicing an air conditioning system that has lost all of its Freon®, it is necessary to

- A — check oil and add as necessary, evacuate the system, relieve vacuum, and add Freon®.
- B — check oil and add as necessary, evacuate the system, and add Freon®.
- C — check oil and add as necessary, and add Freon®.

Answer B. JSAT 14-44 (AC65-15A)

When adding Freon® to a system, add as much oil as is felt was lost. Anytime the system is opened, it must be evacuated.

14C-23 M01A

After cleaning or replacing the filtering element in a combustion heater fuel system, the system should be pressurized and

- A — a sample of fuel taken downstream from the filter to ensure proper operation of the new filtering element.
- B — the fuel filter bypass valve reset to the filter position.
- C — all connections checked for leaks.

Answer C. JSAT 14-30 (AC65-15A)

Fuel leaks, especially with a combustion heater, can be catastrophic in terms of aircraft and personal safety. Any time the fuel system for a combustion heater is worked on, it should be pressurized and leak checked.

14C-24 M01A

The operation of an aircraft combustion heater is usually controlled by a thermostat circuit which

- A — meters the amount of fuel continuously entering the heater and therefore regulates the heater's BTU output.
- B — alternately turns the fuel on and off, a process known as cycling.
- C — regulates the voltage applied to the heater's ignition transformer.

Answer B. JSAT 14-30 (AC65-15A)

To increase or decrease the cabin temperature, combustion heaters usually turn fuel on or off automatically by using an amplifier connected to temperature-sensing devices or by cycling switches which open and close the circuit to the fuel solenoid valve. The heater cycles on and off to maintain the temperature selected on a temperature control rheostat located in the cabin.

14C-25 M01A

The air cycle cooling system produces cold air by

- A — passing air through cooling coils that contain a refrigerant.
- B — extracting heat energy across a compressor.
- C — extracting heat energy across an expansion turbine.

Answer C. JSAT 14-31 (AC65-15A)

In an air-cycle cooling system, compressed air is passed through a turbine which causes the turbine rotor to rotate. When the compressed air performs the work of turning the turbine, it undergoes a pressure and temperature drop. It is this temperature drop which produces the cold air used for air conditioning.

14C-26 M01A

When checking a Freon® system, a steady stream of bubbles in the sight gauge indicates the charge is

- A — correct.
- B — high.
- C — low.

Answer C. JSAT 14-36 (AC65-15A)

The filter/drier in a vapor cycle system usually has a sight glass in it through which the Freon® flow can be observed. A steady flow of Freon® refrigerant observed through the sight glass indicates that sufficient charge is present. If the unit requires additional refrigerant, bubbles will be present in the sight glass.

14C-27 M01A

What unit in a vapor cycle cooling system serves as a reservoir for the refrigerant?

- A — Evaporator.
- B — Receiver dryer.
- C — Condenser.

Answer B. JSAT 14-36

The receiver/dryer is the reservoir for a vapor-cycle air conditioning system. It is located in the high side of the system, between the condenser and the expansion valve.

14C-28 M01A

What is the condition of the refrigerant as it enters the evaporator of a vapor cycle cooling system?

- A — High pressure vapor.
- B — Low pressure liquid.
- C — High pressure liquid.

Answer B. JSAT 14-33 (AC65-15A)

The actual cooling unit in a vapor-cycle air conditioning system is the evaporator. The evaporator is similar to the condenser in construction, but since it is in the low side of the system, the evaporator is not subject to such high pressures as the condenser. The refrigerant enters the evaporator as a liquid and leaves as a gas.

14C-29 M01A

The evacuation of a vapor-cycle cooling system removes any water that may be present by

- A — raising the boiling point of the water and drawing out the vapor.
- B — drawing out the liquid.
- C — lowering the boiling point of the water and drawing out the vapor.

Answer C. JSAT 14-43

No water may be present in a vapor-cycle cooling system. Even a few drops of water can freeze at the thermal expansion valve and block the entire system. To remove water, a vacuum pump is attached to evacuate the system. At the lowered pressure water will boil at temperatures as low as 45°F. The water vapor is then drawn from the system by the vacuum pump.

14C-30 M01A

What is the condition of the refrigerant as it leaves the evaporator of a vapor cycle cooling system?

- A — Low pressure liquid.
- B — High pressure vapor.
- C — Low pressure vapor.

Answer C. JSAT 14-33 (AC65-15A)

The evaporator is in the low pressure side of an air conditioning system. The Freon® enters the evaporator as a liquid, and should use the entire length of the unit when changing from a liquid into a vapor.

14C-31 M01A

In what position should the bottle be placed when adding liquid Freon® to a vapor cycle cooling system?

- A — Vertical with the outlet at the bottom.
- B — Horizontal with the outlet to the side.
- C — Vertical with the outlet at the top.

Answer A. JSAT 14-43

When the Freon® bottle is held vertically with the outlet at the top, gaseous Freon® is introduced to the system. With the outlet at the bottom, however, liquid Freon® is introduced to the system. Liquid Freon® should only be introduced to the system if the low-side pressure is below 40 PSIG and outside temperature above 80°F.

14C-32 M01A

When purging a Freon® air conditioning system, it is important to release the charge at a slow rate. What is the reason for the slow rate discharge?

- A — Prevent excessive loss of refrigerant oil.
- B — Prevent condensation from forming and contaminating the system.
- C — Prevent the large amount of freon from contaminating the surrounding atmosphere.

Answer A. JSAT 14-35 (AC65-15A)

Any time the Freon® system is opened, all of the refrigerant must be purged. When purging the system, care must be taken not to open the valves to the point where the refrigerant can escape fast enough to blow oil out with the vapor.

14C-33 M01A

When a vapor cycle cooling system is not in operation, what is an indication that the system is leaking Freon®?

- A — An ozone-like odor in the immediate area.
- B — Bubbles in the sight glass.
- C — Oil seepage.

Answer C. JSAT 14-44

Compressor oil circulates with the refrigeration fluid. When a leak occurs, naturally oil will stain. The refrigeration fluid is colorless.

14C-34 M01A

In an operating vapor cycle cooling system, if the two lines connected to the expansion valve are essentially the same temperature, what does this indicate?

- A — The expansion valve is not metering freon properly.
- B — The compressor is pumping too much refrigerant.
- C — The system is functioning normally.

Answer A. JSAT 14-36

When both lines are warm, the expansion valve is not working properly, or not working at all.

14C-35 M01A

The purpose of a subcooler in a vapor cycle cooling system is to

- A — aid in quick cooling a hot aircraft interior.
- B — augment the cooling capacity during periods of peak demand.
- C — cool the freon to prevent premature vaporization.

Answer C. JSAT 14-40 (AC65-15A)

By cooling the refrigerant (in a subcooler) premature vaporization (flash-off) can be prevented.

14C-36 M01A

- (1) A small amount of water in a vapor cycle cooling system can freeze in the receiver-dryer and stop the entire system operation.
- (2) Water in a vapor cycle cooling system will react with refrigerant to form hydrochloric acid which is highly corrosive to the metal in the system.

Regarding the above statements,

- A — only No. 1 is true.
- B — both No. 1 and No. 2 are true.
- C — only No. 2 is true.

Answer A. JSAT 14-36

A small amount of water vapor can freeze in the expansion valve, causing the entire system to fail. The receiver-dryer is used to remove such water before it reaches the expansion valve. Water also reacts with refrigerant to form corrosive hydrochloric acid.

14C-37 M01A

When Refrigerant 12 is passed over an open flame, it

- A — is broken down into its basic chemical elements.
- B — changes to methane gas.
- C — changes to phosgene gas.

Answer C. JSAT 14-35 (AC65-15A)

R-12 is not normally toxic, nor is it dangerous when it is breathed. When R-12 passes over an open flame its characteristics change drastically, it becomes deadly phosgene gas.

14C-38 M01A

What type of oil is suitable for use in vapor-cycle cooling system?

- A — Low viscosity engine oil with the inability to absorb water.
- B — Highly refined synthetic oil, free from impurities with special water absorbing additives.
- C — Special high grade refrigeration oil.

Answer C. JSAT 14-35 (AC65-15A)

The only oils recommended by the manufacturers of the cooling system should be used. These are usually highly refined mineral oils that are free from impurities such as water, sulfur, or wax.

14C-39 M01A

(Refer to Airframe figure 13) Determine what unit is located immediately downstream of the expansion valve in a freon refrigeration system.

- A — Condenser.
- B — Compressor.
- C — Evaporator coils

Answer C. JSAT 14-37 (AC65-15A)

The next unit in line of cooling flow after the expansion valve is the evaporator.

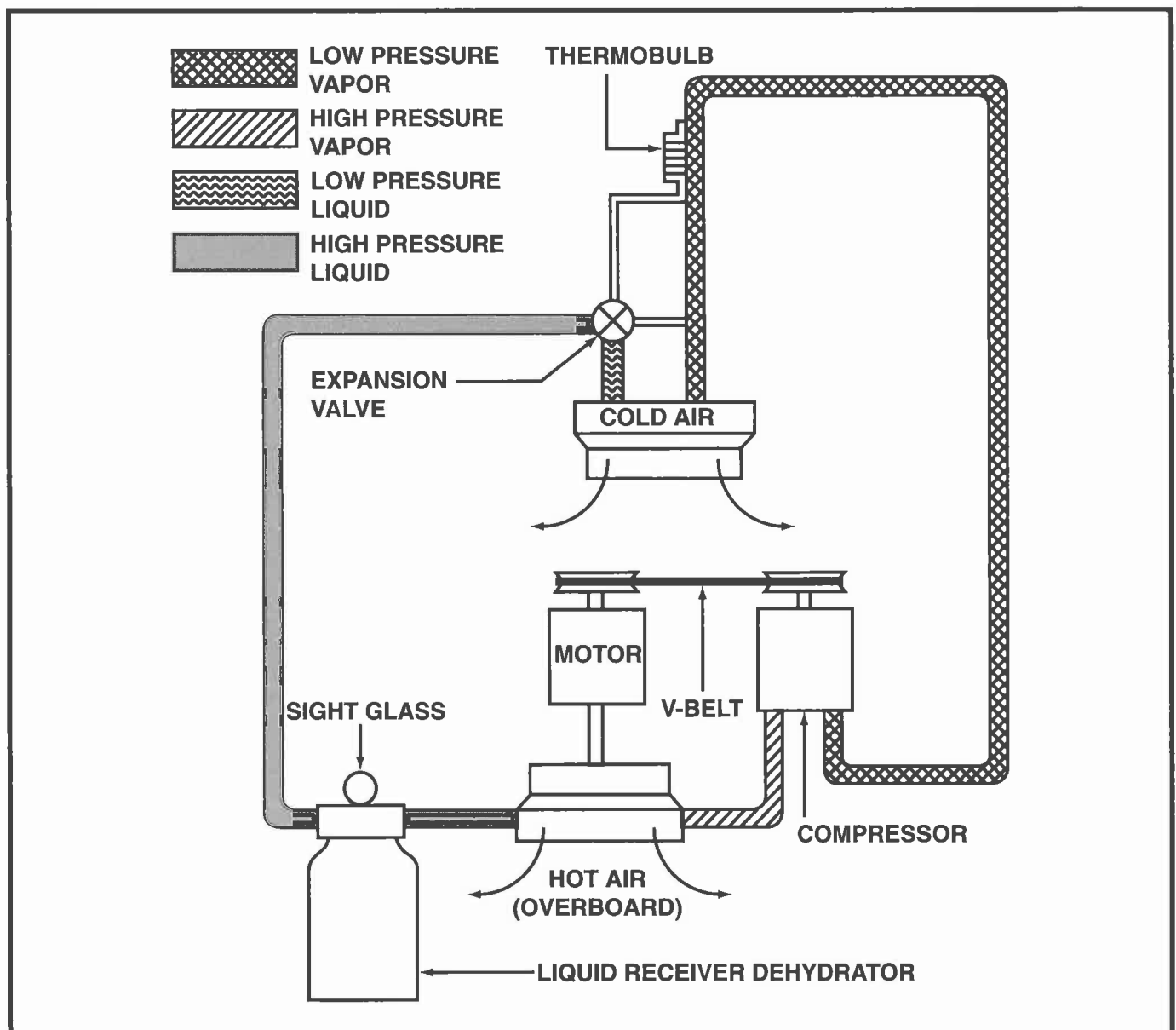


Figure 13. — Cooling System

AIRCRAFT FUEL SYSTEMS

SECTION A

AVIATION FUELS AND FUEL SYSTEM REQUIREMENTS

This section contains information regarding aviation fuels, and the regulatory requirements for aircraft fuel system designs and placards.

15A-1 P01A

- (1) The fuel jettison valve must be designed to allow flight personnel to close the valve during any part of the jettisoning operation.
- (2) During the fuel jettisoning operation, the fuel must discharge clear of any part of the airplane.

Regarding the above statements,

- A — neither No. 1 nor No. 2 is true.
- B — both No. 1 and No. 2 are true.
- C — only No. 2 is true.

Answer B. JSAT 15-9 (FAR 23.1001)
According to FAR 23, both of the statements in the question are true. The fuel jettisoning valve must be designed to allow flight personnel the ability to close it during any phase of the jettisoning operation. In addition, the fuel must discharge clear of any part of the airplane.

15A-2 P01A

A fuel jettison system is required under certain conditions if the maximum takeoff weight exceeds the maximum landing weight. What regulations cover the requirements of fuel jettisoning?

- A — Federal Aviation Regulation Part 43 and 91.
- B — Federal Aviation Regulation Part 23, 25 and CAM 4b.
- C — Federal Aviation Regulation Part 21, 43 and CAM 8.

Answer B. JSAT 15-9 (FAR 23 AC65-9A)
According to FAR 23, a fuel jettison system is required for transport category and general aviation aircraft if the maximum takeoff weight exceeds the maximum landing weight.

15A-3 P02A

The use of turbine fuels in aircraft has resulted in some problems not normally associated with aviation gasoline. One of these problems is

- A — microbial contaminants.
- B — increasing viscosity of fuel as fuel temperature lowers at altitude.
- C — higher vapor pressure.

Answer A. JSAT 15-8 (AC65-9A)
Microbial growth, or contamination with bacteria, or “bugs,” has become a critical problem in some turbine fuel systems. Because microbes thrive in water, a simple and effective method to prevent or retard their growth is to eliminate the water.

15A-4 P04A

Entrained water in aviation turbine fuel is a hazard because of its susceptibility to freezing as it passes through the filters. What are common methods of preventing this hazard?

- A — Micromesh fuel strainers and fuel heater.
- B — Anti-icing fuel additives and fuel heater.
- C — High-velocity fuel pumps and fuel heater.

Answer B. JSAT 15-7

Jet engine fuel control mechanisms contain many small parts that are susceptible even to small accumulations of ice. Fuel heaters protect fuel systems that are subject to ice crystals. These devices can satisfactorily deal with dissolved and even entrained water; however, there is little margin for handling large amounts of free water. Some fuel filters are equipped with a differential pressure sensor across the filter element. This sensor will illuminate a warning light on the instrument panel if the filter ices up and the pressure drop across the element rises to the preset value. To further minimize the ice problem, most jet fuel is treated with an anti-icing additive that mixes with the water in the fuel and lowers its freezing point so it will remain in its liquid state.

15A-5 P04A

Why are jet fuels more susceptible to water contamination than aviation gasoline?

- A — Jet fuel is lighter than gasoline; therefore, water is more easily suspended.
- B — Condensation is greater because of the higher volatility of jet fuels.
- C — Jet fuel has a higher viscosity than gasoline.

Answer C. (AC65-9A)

The high viscosity of jet fuel causes it to hold water in suspension much more readily than aviation gasoline.

15A-6 P04A

When installing a rigid fuel line, 1/2 inch in diameter, at what intervals should the line be supported?

- A — 12 inches.
- B — 16 inches.
- C — 24 inches.

Answer B. JSAT 10-11 (AC43.13-1B)

On 1/2-inch diameter fuel lines, support clamps or brackets should be spaced no more than 16 inches apart.

15A-7 P05A

How does temperature affect fuel weight?

- A — Warm fuel is heavier per gallon.
- B — Temperature has no effect.
- C — Cold fuel is heavier per gallon.

Answer C. JSAT 15-2 (AC65-9A)

A gallon of gasoline weighs more when it is cold because the volume and density of fuel changes with the temperature.

15A-8 P07A

What minimum required markings must be placed on or near each appropriate fuel filler cover on utility category aircraft?

- A — The word "Avgas" and the minimum fuel grade or designation for the engines, and the usable fuel tank capacity.
- B — The word "Avgas" and the minimum fuel grade, and the total fuel tank capacity.
- C — The word "Avgas" and the minimum fuel grade .

Answer C. JSAT 15-9

According to FAR 23, placed on or near the fuel cover of utility category aircraft there must be the word "Avgas", the fuel grade or permissible fuel designations, and the maximum permissible fueling and defueling pressure for pressure fueling systems.

15A-9 P07A

What is one disadvantage of using aromatic aviation fuels?

- A — Results in low fuel volatility.
- B — A fuel intercooler is required.
- C — Deteriorates rubber parts.

Answer C. JSAT 15-3 (AC65-9A)

Fuels known as aromatic fuels have a strong solvent and swelling action on some types of hose and other rubber parts of the fuel system.

15A-10 P07A

According to Part 23, what minimum required markings must be placed at or near each appropriate fuel filler cover for reciprocating engine-powered airplanes?

- A — The word "Avgas" and the minimum fuel grade.
- B — The word "Fuel" and usable fuel capacity.
- C — The word "Avgas" and the total fuel capacity.

Answer A. JSAT 15-9 (AC65-9A)

On small airplanes, the word "Avgas" and the minimum fuel grade or designation for the engine must be placed on or near the fuel filler cover. This is done in an effort to prevent the servicing of the tank with the wrong kind of fuel.

15A-11 P07A

- (1) If aviation gasoline vaporizes too readily, fuel lines may become filled with vapor and cause increased fuel flow.
- (2) A measure of a gasoline's tendency to vapor lock is obtained from the Reid vapor pressure test.

Regarding the above statements,

- A — only No. 2 is true.
- B — both No. 1 and No. 2 are true.
- C — neither No. 1 nor No. 2 is true.

Answer A. JSAT 15-3 (AC65-9A)

The first statement is not true because when we have too much vapor in a fuel line we have a reduction in fuel flow. But fuel vapor pressure or its tendency to vapor lock is measured by a Reid vapor pressure test apparatus.

15A-12 P07A

The vapor pressure of aviation gasoline is

- A — lower than the vapor pressure of automotive gasoline.
- B — approximately 20 PSI at 100°F.
- C — higher than the vapor pressure of automotive gasoline.

Answer A. JSAT 15-2

Aviation gasoline is required to have a vapor pressure of between 5.5 and 7.0 PSI at 100°F, as opposed to vapor pressures often as high as 14 PSI found in automotive gasoline's.

15A-13 P07A

What is the maximum vapor pressure allowable for an aircraft fuel?

- A — 7 PSI.
- B — 3 PSI.
- C — 5 PSI.

Answer A. JSAT 15-3

Aviation gasoline is required to have a vapor pressure of between 5.5 and 7.0 PSI.

15A-14 P07A

How may the antiknock characteristics of a fuel be improved?

- A — By adding a knock enhancer.
- B — By adding a knock inhibitor.
- C — By adding a fungicide agent.

Answer B. JSAT 15-4 (AC65-9A)

A convenient means of improving the anti-knock characteristics of a fuel is to add a knock inhibitor.

SECTION B FUEL SYSTEM OPERATION

Section B of Chapter 14 contains information on fuel system components including fuel tanks, selector valves, jettison valves, refueling systems, and other similar devices. This section also contains information on fuel system operations.

15B-1 P01A

Fuel jettisoning is usually accomplished

- A — by gravity flow into the outboard wing tanks and overboard through a common outlet in each wing.
- B — through individual outlets for each tank.
- C — through a common manifold and outlet in each wing.

Answer C. JSAT 15-16 (AC65-9A)

The fuel jettisoning system of an aircraft is usually divided into two separate, independent systems, one for each wing, so that lateral stability can be maintained by jettisoning fuel from the "heavy" wing. Each wing contains either a fixed or an extendable dump chute, depending upon system design. (See Figure 15-10 in the Jeppesen Airframe Textbook.)

15B-2 P01A

The primary purpose of an aircraft's fuel jettison system is to quickly achieve a

- A — lower landing weight.
- B — reduced fire hazard.
- C — balanced fuel load.

Answer A. JSAT 15-9 (FAR 23.1001)

If an aircraft's landing weight is less than its take-off weight a means must be provided to jettison fuel to achieve a safe landing weight.

15B-3 P01A

Which of the following is employed to maintain lateral stability when jettisoning fuel?

- A — Crossfeed system.
- B — Two interconnected systems.
- C — Two separate independent systems.

Answer C. JSAT 15-17 (AC65-9A FAR 23.1001)

The fuel jettisoning system is usually divided into two separate, independent systems, one for each wing, so that lateral stability can be maintained by jettisoning fuel from the "heavy" wing.

15B-4 P01A

Fuel is moved overboard in most fuel jettison systems by

- A — gravity.
- B — boost pumps.
- C — gravity and engine driven fuel pumps.

Answer B. JSAT 15-32

Systems operation may vary from aircraft to aircraft, but the fuel boost pumps alone, or a combination of boost pumps and gravity will be used to jettison fuel.

15B-5 P01A

Fuel jettisoning past the limits prescribed by Federal Aviation Regulations is usually prevented by

- A — dump limit valves or a low-level circuit.
- B — standpipes in the fuel tanks.
- C — closely monitoring the fuel quantity and turning off the fuel dump switch(es).

Answer A. JSAT 15-17

There is a fuel dump limit-valve in each fuel tank that will shut off the flow if the pressure drops below what is needed to supply the engine with adequate fuel. It will also shut off the dump valve when the level in the tank gets down to the preset dump shut-off level.

15B-6 P02A

Normal fuel cross-feed system operation in multi-engine aircraft

- A — reduces contamination and/or fire hazards during fueling or defueling operations.
- B — provides a means to maintain a balanced fuel load condition.
- C — calls for jettisoning of fuel overboard to correct lateral instability.

Answer B. JSAT 15-13

Cross-feed valves are used to allow fuel to either be moved from tank to tank, or from either tank to either or both engines.

15B-7 P02A

What is the primary purpose of the crossfeed system?

- A — To provide automatic refueling of a tank to any desired level.
- B — To allow the feeding of any engine from any tank.
- C — To allow the feeding of fuel from one tank for defueling.

Answer B. JSAT 15-15 (AC65-9A)

The individual engine fuel systems must be interconnected so fuel can be fed from the various tanks to any engine. Cross-feed valves are used to allow fuel to either be moved from tank to tank, or from either tank to either or both engines.

15B-8 P02A

A typical large transport aircraft fuel manifold system allows how many of the following?

1. All tanks can be serviced through a single connection.
2. Any engine can be fed from any tank.
3. All engines can be fed from all tanks simultaneously.
4. A damaged tank can be isolated from the rest of the fuel system.

A — Three.

B — Two.

C — Four.

Answer C. JSAT 15-14 (AC65-9A)

The individual engine fuel systems must be interconnected so fuel can be fed from the various tanks to any engine. In case of engine failure, the fuel supplied to the inoperative engine must be made available to other engines.

15B-9 P02A

What is used in many aircraft to prevent bubbles in the fuel after it leaves the tank when atmospheric pressure is lower than fuel vapor pressure?

A — Air fuel separators.

B — Boost pumps.

C — Anti-foaming additives.

Answer B. JSAT 15-24 (AC65-9A)

Some centrifugal boost pumps have a small agitator on the pump shaft that stirs up the fuel being drawn into the impeller. Any of the tiny vapor bubbles that form in the fuel are forced to coalesce into larger bubbles and rise to the top of the tank rather than enter the fuel line.

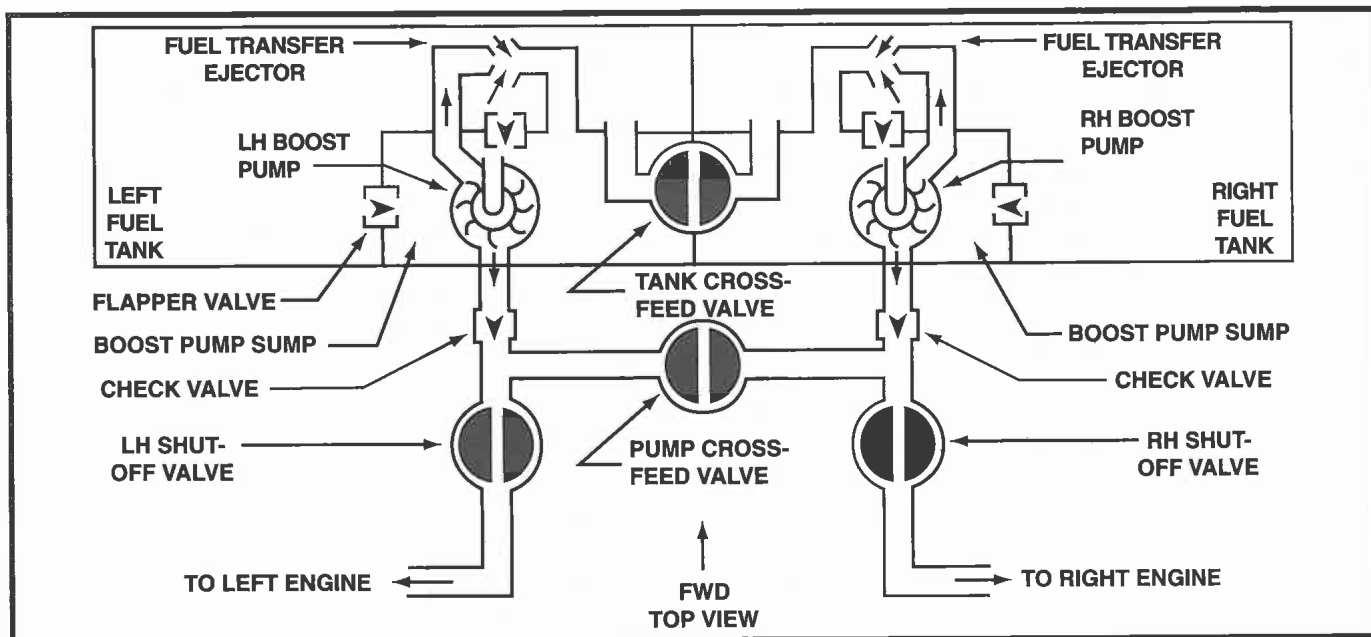


Figure 17. — Fuel System

15B-10 P02A

(Refer to Airframe figure 17) What is the purpose of the pump crossfeed valve?

- A — Balance the fuel in the tanks.
- B — Allow operation of engines from one tank.
- C — Allow operation of the left engine when the right fuel boost pump is inoperative.

Answer B. JSAT 15-13 (AC65-9A)
Crossfeed valves are used to allow fuel to either be moved from tank to tank, or from either tank to either or both engines. The pump crossfeed in figure 17 is used to route fuel from either tank to either or both engines.

15B-11 P04A

How is the outlet fuel pressure regulated on a submerged, single speed, centrifugal type fuel pump?

- A — By the first check valve downstream from the pump.
- B — By the pump's design and internal clearances.
- C — By the engine driven pump's design and internal clearance.

Answer B. JSAT 15-24 (AC65-9A)
Centrifugal-type fuel boost pumps are not positive displacement pumps, meaning they do not necessarily pump a certain amount of fuel per revolution. The amount of pressure they are capable of generating is determined by the clearance between the pump's impeller and the case.

15B-12 P04A

What is one purpose of a fuel tank vent?

- A — To decrease tank internal air pressure.
- B — To decrease fuel vapor pressure.
- C — To maintain atmospheric pressure.

Answer C. JSAT 15-18 (AC65-9A)
As fuel is being drawn from a tank, a partial vacuum will try to form because of the void formed as the fuel leaves the tank. To prevent this partial vacuum from forming, fuel tanks are vented so that atmospheric pressure can occupy the space above the fuel.

15B-13 P04A

An aircraft's integral fuel tank is

- A — a part of the aircraft structure.
- B — usually located in the bottom of the fuselage.
- C — a self sealing tank.

Answer A. JSAT 15-19 (AC65-9A)
An aircraft's integral fuel tank is a non-removable part of the aircraft structure.

15B-14 P04A

Why is the main fuel strainer located at the lowest point in the fuel system?

- A — It filters and traps all micro-organisms that may be present in the fuel system.
- B — It provides a drain for residual fuel.
- C — It traps any small amount of water that may be present in the fuel system.

Answer C. JSAT 15-27 (AC65-9A)

The fuel system's main strainer is installed in such a way that all the fuel flows through it before reaching the engine-driven pump. It is located at the lowest point in the fuel system so that it can trap any water that may be present.

15B-15 P04A

The purpose of a diaphragm in a vane type fuel pump is to

- A — compensate fuel pressures to altitude changes.
- B — vary fuel pressure according to throttle setting.
- C — equalize fuel pressure at all speeds.

Answer A. JSAT 15-26 (AC65-9A)

Vane-type fuel pumps have an adjustment to set fuel pressure. Some pumps have a diaphragm that automatically adjusts fuel pressure for altitude.

15B-16 P04A

When moving the mixture control on a normally operating engine into the idle cutoff position, engine RPM should

- A — slightly increase before the engine starts to die.
- B — remain the same until the cutoff is effected, then drop rapidly.
- C — slightly decrease and then drop rapidly.

Answer A. JSGT 7-32

When the mixture control on a normally operating engine is moved to the idle cutoff position, the RPM should increase slightly before dropping off to zero. A rise of 10 to 35 RPM should be seen. This is because engines are normally operated at a mixture slightly richer than optimum for cooling purposes.

15B-17 P04A

What method would be used to check for internal leakage of a fuel valve without removing the valve from the aircraft?

- A — Apply regulated air pressure on the downstream side of the fuel pump and listen for air passing through the valve.
- B — Place the valve in the OFF position, drain the strainer bowl, and with boost pump on, watch to see if fuel flows to the strainer bowl.
- C — Remove fuel cap(s), turn boost pump(s) on, and watch for bubbling in the tanks.

Answer B. (AC43.13-B)

Internal leakage of a fuel valve can be checked by placing the appropriate valve in the OFF position, draining the fuel strainer bowl, and observing if fuel continues to flow into it.

15B-18 P05A

The capacitance type (electronic) fuel quantity indicator

- A — has no moving parts in the tank.
- B — has two tubes separated by a mica dielectric in the tank.
- C — utilizes a float operated variable capacitor.

Answer A. JSAT 11-34, 15-29 (AC65-9A)

The electronic-type (capacitance) fuel quantity gage differs from other types in that it has no movable devices in the fuel tank.

15B-19 P05A

What type of remote reading fuel quantity indicating system has several probes installed in each fuel tank?

- A — Direct reading.
- B — Electromechanical.
- C — Electronic.

Answer C. JSAT 11-34 (AC65-9A AC65-15A)

The electronic or capacitance-type fuel quantity indicating system utilizes several probes installed in each fuel tank. By using more than one probe in each tank, the effect which the attitude of the aircraft would have on the fuel quantity reading is compensated for.

15B-20 P05A

Which aircraft fuel quantity indicating system incorporates a signal amplifier?

- A — Electrical.
- B — Sight glass.
- C — Electronic.

Answer C. JSAT 15-29 (AC65-9A)

In an electronic-type fuel quantity indicating system, the capacitance of the transmitter is compared to a reference capacitor in a rebalance-type bridge circuit. The unbalanced signal is amplified by the voltage amplifiers that drive a phase discriminating power stage.

15B-21 P05A

The electronic type fuel quantity indicating system consists of a bridge circuit,

- A — an amplifier, an indicator, and a tank unit.
- B — a tank, an amplifier, and an indicator.
- C — a tank unit, a tank, and an amplifier.

Answer A. JSAT 15-29 (AC65-9A AC65-15A)

The basic components of a capacitor-type (electronic) fuel quantity indicating system are an indicator, a tank probe, a bridge unit, and an amplifier.

15B-22 P05A

A probe or a series of probes is used in what kind of fuel quantity indicating system?

- A — Capacitor.
- B — Synchro.
- C — Selsyn.

Answer A. JSAT 11-34 (AC65-9A AC65-15A)

A single probe in a tank, or possibly a series of probes in a tank, is used in a capacitor-type (electronic) fuel quantity indicating system.

15B-23 P05A

One advantage of electrical and electronic fuel quantity indicating systems is that

- A — the indicators are calibrated in gallons; therefore, no conversion is necessary.
- B — only one transmitter and one indicator are needed regardless of the number of tanks.
- C — several fuel tank levels can be read on one indicator.

Answer C. JSAT 11-35 (AC65-9A)

Two important advantages of the electrical and electronic-type fuel quantity indicating systems are that the fuel quantity indicator can be located any distance from the tank, and fuel levels of several tanks can be read on one indicator.

15B-24 P05A

A fuel totalizer is a component which indicates the

- A — total amount of fuel being consumed by all engines.
- B — amount of fuel in any given tank.
- C — amount of fuel in all tanks.

Answer C. JSAT 11-35 (AC65-9A)

On some aircraft, one fuel gage, called a totalizer, indicates the total amount of fuel remaining in all the fuel tanks.

15B-25 P05A

What is the dielectric (nonconducting material) in a capacitance type fuel quantity indicating system?

- A — Outer shell of the capacitor.
- B — Fuel in the tank.
- C — Fuel and air in the tank.

Answer C. JSAT 11-34, JSAT 15-29 (AC65-9A)

The dielectric (or nonconducting material) of the condenser of a capacitor-type fuel quantity indicating system is fuel and air above the fuel in the tank. The capacitance probes extend from the top to the bottom of the tank. When the tank is empty, the plates are separated by air that has a dielectric constant of one. When the tank is full, the dielectric is fuel that has a constant of approximately two. In any condition between full and empty, part of the dielectric is air, part is fuel, and so the capacitance of the probe varies according to the level of fuel in the tank.

15B-26 P05A

What are the four general types of fuel quantity gauges?

1. Sight glass.
2. Mechanical.
3. Electrical.
4. Electronic.
5. Bourdon tube.
6. Vane type transmitter.
7. Litmus indicator.
8. Direct reading static pressure type.

A — 2, 3, 5, and 7.

B — 1, 3, 6, and 8.

C — 1, 2, 3, and 4.

Answer C. JSAT 11-33 (AC65-15A)

The four types of fuel quantity gages are sight glass, mechanical, electrical and electronic.

15B-27 P05A

One advantage of electrical and electronic fuel quantity indicating systems is that the indicator

A — can be located any distance from the tank(s).

B — always measures volume instead of mass.

C — has no movable devices.

Answer A. JSAT 11-34 (AC65-9A)

One advantage of the electric and electronic type of fuel quantity gages is they can be located any distance from the tank because they use an electrical wire to carry their information.

15B-28 P05A

When fuel quantity is measured in pounds instead of gallons, the measurement will be more accurate because fuel volume

A — increases when temperature decreases.

B — varies with temperature change.

C — varies with changes in atmospheric pressure.

Answer B. JSAT 15-2 (AC65-9A)

Fuel volume varies with temperature, the higher the temperature the more the fuel expands. Colder temperatures contract the fuel volume.

15B-29 P05A

An electrical type fuel quantity indicating system consists of an indicator in the cockpit and a

A — float operated transmitter installed in the tank.

B — float operated receiver installed in the tank.

C — float resting on the surface of the tank.

Answer A. JSAT 11-33 (AC65-9A)

An electrical type fuel quantity gage consists of a float-operated transmitter located in the fuel tank and an indicator located in the cockpit.

15B-30 P05A

What is the purpose of a float operated transmitter installed in a fuel tank?

A — It sends an electric signal to the fuel quantity indicator.

B — It senses the dielectric qualities of fuel and air in the tank.

C — It senses the total amount of fuel density.

Answer A. JSAT 11-33 (AC65-9A)

The transmitter sends an electrical signal to the indicator. In most cases, a direct connection between the float and the indicator is not possible. A DC electrical transmitter solves this problem. It converts mechanical motion of the float into a varying direct current. This current then drives a mechanical indicator or is converted to a digital readout.

15B-31 P05A

In an electronic type fuel quantity indicating system, the tank sensing unit is a

A — variable resistor.

B — capacitor.

C — variable inductor.

Answer B. JSAT 11-34 (AC65-9A)

The tank transmitter is a simple electric capacitor. Many modern aircraft use an electronic fuel quantity measuring system that factors in fuel density, as well as volume using capacitors that serve as the tank sender units.

15B-32 P05A

The probe of a capacitance type fuel level gauge is essentially a

- A — float actuated variable capacitor.
- B — capacitor with fuel and air acting as one plate.
- C — capacitor with fuel and air acting as a dielectric.

Answer C. JSAT 15-29 (AC65-9A)

Instead of using the float and its attendant mechanical units, the capacitance-type fuel quantity gage uses the dielectric qualities of fuel and air to furnish a measurement of fuel quantity. Essentially, the tank transmitter is a simple electric condenser.

15B-33 P05A

A drip gauge may be used to measure

- A — the amount of fuel in the tank.
- B — system leakage with the system shut down.
- C — fuel pump diaphragm leakage.

Answer A. JSAT 15-29 (AC65-9A)

A drip gage is a type of bayonet gage which is used to measure, by manual means, the fuel quantity in the tank.

15B-34 P05A

Why is the capacitance fluid quantity indicating system more accurate in measuring fuel level than a mechanical type?

- A — It measures by weight instead of volume.
- B — Only one probe and one indicator are necessary for multiple tank configurations.
- C — It measures in gallons and converts to pounds.

Answer A. JSAT 15-29 (AC65-9A)

A nice feature of the capacitor-type (electronic) fuel quantity indicating system is that it does not measure fuel quantity by volume, but rather by mass. Engines consume fuel in pounds per hour (indicated on a fuel-flow gage), so it is more valuable to know how many pounds of fuel are in the tanks rather than how many gallons.

15B-35 P05A

A capacitance type fuel quantity indicating system measures fuel in

- A — pounds per hour.
- B — pounds.
- C — gallons.

Answer B. JSAT 15-29

The density of the fuel affects its dielectric constant and thus the capacity of the probe. Because of this, the system indicates the number of pounds of fuel remaining in the aircraft.

15B-36 P06A

What unit would be adjusted to change the fuel pressure warning limits?

- A — Fuel pressure relief valve.
- B — Fuel flow meter bypass valve.
- C — Pressure sensitive mechanism.

Answer C. (AC65-9A)

The fuel pressure warning light is illuminated in the cockpit when the fuel pressure, acting on a pressure-sensitive mechanism, falls below a pre-set value. The value at which the light will illuminate is changed by changing the tension on a spring which is inside the mechanism.

15B-37 P06A

What unit is generally used to actuate the fuel pressure warning system?

- A — Pressure sensitive mechanism.
- B — Fuel pressure gauge.
- C — Fuel flow meter.

Answer A. (AC65-9A)

In a fuel pressure warning system, it is the pressure sensitive mechanism which activates the warning light in the cockpit.

15B-38 P06A

Select one means of controlling the fuel temperature on turbine-powered aircraft.

- A — Engine bleed air to the fuel filter.
- B — Engine bleed air to a heat exchanger.
- C — Engine bleed air to the fuel tank.

Answer B. JSAT 15-28

A typical means of heating the fuel in a turbine engine powered aircraft is by using an air-to-fuel heat exchanger. This unit makes use of compressor bleed air, which is at an elevated temperature because of compression, and passes it around tubes through which fuel is flowing. The air gives up its heat to the fuel and then is dumped overboard.

15B-39 P06A

What is the purpose of flapper type check valves in integral fuel tanks?

- A — To allow the engine driven pumps to draw fuel directly from the tank if the boost pump fails.
- B — To prevent fuel from flowing away from the boost pumps.
- C — To allow defueling of the tanks by suction.

Answer B. JSAT 15-18 (AC65-9A)

Flapper-type check valves, when used in an integral fuel tank, are designed to prevent the fuel from flowing away from the boost pump when the aircraft is in a high "G" maneuver. Without the check valve, the boost pump could be starved for fuel during the maneuver. Some aircraft employ baffles for the same purpose.

15B-40 P06A

What method is used on turbine powered aircraft to determine when the condition of the fuel is approaching the danger of forming ice crystals?

- A — Fuel temperature indicator.
- B — Fuel pressure gauge.
- C — Fuel pressure warning.

Answer A. JSAT 15-28 (AC65-9A)

Turbine-powered aircraft that operate at high altitudes and low temperatures for extended periods of time have a problem with water condensing out of the fuel and freezing. Ice crystals may collect on the fuel filters and shut off fuel flow to the engine. To prevent this, these aircraft have a fuel temperature gauge to inform the flight crew when there is a danger of ice formation.

15B-41 P06A

Which of the following would give the first positive indication that a change over from one fuel tank to another is needed?

- A — Fuel quantity indicator.
- B — Fuel pressure gauge.
- C — Fuel pressure warning.

Answer C. (AC65-9A)

In an aircraft with several fuel tanks, there is a danger of allowing the fuel supply in one tank to become exhausted before the selector valve is switched to another tank. To prevent this, pressure warning signal devices are installed in some aircraft. When the fuel pressure drops below a predetermined limit, the switch illuminates a warning light on the instrument panel.

15B-42 P06A

A fuel pressure warning switch contacts close and warning light is turned on when

- A — the fuel flow stops.
- B — the fuel pressure drops below specified limits.
- C — a measured quantity of fuel has passed through it.

Answer B. (AC65-9A)

In an aircraft with several fuel tanks, there is a danger of allowing the fuel supply in one tank to become exhausted before the selector valve is switched to another tank. To prevent this, pressure warning signal devices are installed in some aircraft. When the fuel pressure drops below a predetermined limit, the switch illuminates a warning light on the instrument panel

15B-43 P06A

A transmitter in a fuel pressure warning system serves what function?

- A — Transmits an electrical signal to fluid pressure.
- B — Transmits fluid pressure directly to the indicator.
- C — Converts fluid pressure to an electrical signal.

Answer C. (AC65-9A)

A fuel pressure warning mechanism senses fuel pressure against a diaphragm by balancing the pressure with a spring. If the fuel pressure drops below a specified value, the spring force closes a set of contacts, which causes an electrical signal to be sent to the cockpit to turn on the warning light.

15B-44 P06A

Where is fuel pressure taken for the pressure warning signal on most aircraft engines?

- A — Between the fuel pump and the strainer.
- B — Fuel pressure line of the carburetor.
- C — Outlet side of the boost pump.

Answer B. (AC65-9A)

The fuel pressure signal sent to the pressure warning mechanism is tapped from the fuel pressure line to the carburetor.

15B-45 P06A

In some aircraft with several fuel tanks, the possible danger of allowing the fuel supply in one tank to become exhausted before the selector valve is switched to another tank is prevented by the installation of

- A — a fuel pressure warning signal system.
- B — an engine fuel pump bypass valve.
- C — a fuel pressure relief valve.

Answer A. (AC65-9A)

On some airplanes a pressure warning switch is installed in the fuel pressure gauge line. When the fuel pressure drops below a predetermined pressure, the switch illuminates a warning light on the instrument panel.

15B-46 P06A

- (1) The function of a fuel heater is to protect the engine fuel system from ice formation.
- (2) An aircraft fuel heater cannot be used to thaw ice in the fuel screen. Regarding the above statements,

- A — only No. 1 is true.
- B — both No. 1 and No. 2 are true.
- C — only No. 2 is true.

Answer A. JSAT 15-28 (AC65-12A)

The function of a fuel heater is to protect the engine fuel system from ice formation. However, should ice form, the heater can also be used to thaw ice on the fuel screen.

15B-47 P06A

- (1) Gas turbine engine fuel systems are very susceptible to the formation of ice in the fuel filters.
- (2) A fuel heater operates as a heat exchanger to warm the fuel. Regarding the above statements,

- A — only No. 1 is true.
- B — only No. 2 is true.
- C — both No. 1 and No. 2 are true.

Answer C. JSAT 15-28 (AC65-12A)

Turbine-powered aircraft that operate at high altitudes and low temperatures for extended periods of time have a problem with water condensing out of the fuel and freezing. Ice crystals may collect on the fuel filters and shut off fuel flow to the engine. To prevent this, a fuel heater is used to warm the fuel.

15B-48 P06A

- (1) A fuel heater can use engine bleed air as a source of heat.
- (2) A fuel heater can use engine lubricating oil as a source of heat.

Regarding the above statements,

- A — both No. 1 and No. 2 are true.
- B — only No. 1 is true.
- C — neither No. 1 nor No. 2 is true.

Answer A. JSAT 15-28 (AC65-12A)

A fuel heater can use either engine bleed air or a fuel/engine-oil heat exchanger as a source of heat.

15B-49 P06A

- (1) A fuel pressure gauge is a differential pressure indicator.
- (2) A fuel pressure gauge indicates the pressure of the fuel entering the carburetor.

Regarding the above statements,

- A — both No. 1 and No. 2 are true.
- B — only No. 2 is true.
- C — neither No. 1 nor No. 2 is true.

Answer A. JSAT 15-31 (AC65-9A)

The fuel pressure gage is a differential pressure gage used to indicate the pressure of the fuel entering the carburetor.

15B-50 P06A

- (1) A fuel pressure relief valve is required on an aircraft positive displacement fuel pump.
- (2) A fuel pressure relief valve is required on an aircraft centrifugal fuel boost pump.

Regarding the above statements,

- A — both No. 1 and No. 2 are true.
- B — only No. 2 is true.
- C — only No. 1 is true.

Answer C. JSAT 15-27 (AC65-9A)

Only the positive displacement needs a relief valve. The centrifugal type is not a positive displacement pump.

15B-51 P07A

A fuel temperature indicator is located in the fuel tanks on some turbine powered airplanes to tell when the fuel may be

- A — about to form rime ice.
- B — getting cold enough to form hard ice.
- C — in danger of forming ice crystals.

Answer C. JSAT 15-7 (AC65-9A)

During extreme cold, especially at high altitude, turbine engine fuel is susceptible to the formation of ice crystals. To alert the crew to this potential problem, some fuel tanks are fitted with a temperature probe which powers a temperature gage in the cockpit.

15B-52 P07A

The primary purpose of a fuel tank sump is to provide a

- A — place where water and dirt accumulations in the tank can collect and be drained.
- B — positive system of maintaining the design minimum fuel supply for safe operation.
- C — reserve supply of fuel to enable the aircraft to land safely in the event of fuel exhaustion.

Answer A. JSAT 15-27 (AC65-9A)

A fuel tank sump is the lowest point in the fuel tank, so this is where the water and solid contaminants will collect and can be readily drained.

15B-53 P07A

Why are integral fuel tanks used in many large aircraft?

- A — To facilitate servicing.
- B — To reduce weight.
- C — To reduce fire hazards.

Answer B. JSAT 15-19

Because an integral fuel tank makes use of the existing structure of the airframe, it saves a great deal of weight over the bladder or rigid type fuel tank.

15B-54 P07A

Integral fuel tanks are

- A — usually constructed of nonmetallic material.
- B — readily removed from the aircraft.
- C — formed by the aircraft structure.

Answer C. JSAT 15-19 (AC65-9A)
Integral fuel tanks are usually built into the structure of the aircraft's wings. By sealing off the inner cavity of the wing, a fuel tank is created.

15B-55 P07A

What precautions must be observed if a gravity feed fuel system is permitted to supply fuel to an engine from more than one tank at a time?

- A — Each tank must have a valve in its outlet that automatically shuts off the line when the tank is empty.
- B — The fuel outlet ports of each tank must have the same cross sectional area.
- C — The tank airspaces must be interconnected.

Answer C. JSAT 15-10
According to FAR 23, the airspaces of fuel tanks with interconnected outlets must also be interconnected. This is done so the system can draw a vent through either tank.

15B-56 P07A

The purpose of the baffle plate in a fuel tank is to

- A — resist fuel surging within the fuel tank.
- B — provide internal structural integrity.
- C — provide an expansion space for the fuel.

Answer A. JSAT 15-18 (AC65-9A)
The baffle plate in a fuel tank is designed to resist fuel surging caused by changes in the attitude of the aircraft.

15B-57 P07A

Fuel boost pumps are operated

- A — automatically from fuel pressure.
- B — primarily for fuel transfer.
- C — to provide a positive flow of fuel to the engine.

Answer C. JSAT 15-24 (AC65-9A)
The electrically driven centrifugal boost pump, found in many fuel tanks, supplies fuel under pressure to the inlet of the engine-driven fuel pump.

15B-58 P07A

Flapper valves are used in fuel tanks to

- A — act as check valves.
- B — reduce pressure.
- C — prevent a negative pressure.

Answer A. JSAT 15-18 (AC65-9A)
Flapper valves are used in fuel tanks to prevent fuel from flowing away from the boost pump or tank outlet when the aircraft is in a high "G" maneuver. In this capacity, they serve as check valves. Some tanks utilize baffles instead of flapper valves.

15B-59 P07A

Why are centrifugal type boost pumps used in fuel systems of aircraft operating at high altitude?

- A — To permit cooling air to circulate around the motor.
- B — To supply fuel under pressure to engine driven pumps.
- C — Because they are positive displacement pumps.

Answer B. JSAT 15-24 (AC65-9A)
A centrifugal-type boost pump is an essential part of the fuel system of high altitude aircraft, because it keeps the pressure on the suction side of the engine-driven pump from becoming low enough to permit the fuel to boil. It also helps keep air out of the system.

15B-60 P07A

Why is it necessary to vent all aircraft fuel tanks?

- A — To ensure a positive head pressure for a submerged boost pump.
- B — To exhaust fuel vapors.
- C — To limit pressure differential between the tank and atmosphere.

Answer C. JSAT 15-18 (AC65-9A)

Fuel tanks are vented to the outside air to maintain atmospheric pressure within the tank. Without the vent, the space above the fuel would become a partial vacuum as the fuel was drawn out of the tank. This condition could cause structural damage to the tank, and it could also inhibit the flow of fuel to the engine.

15B-61 P07A

What type of fuel booster pump requires a pressure relief valve?

- A — Centrifugal.
- B — Sliding vane.
- C — Concentric.

Answer B. JSAT 15-27 (AC65-9A)

Since a sliding vane type of fuel boost pump is a positive displacement type, it must have a relief valve to prevent excessive pressure.

15B-62 P07A

To prevent vapor lock in fuel lines at high altitude, some aircraft are equipped with

- A — vapor separators.
- B — booster pumps.
- C — direct injection type carburetors.

Answer B. JSAT 15-24 (AC65-9A)

One of the nice features of a centrifugal-type fuel boost pump is its tendency to separate the air from the fuel as it supplies fuel to the engine-driven fuel pump. As the fuel enters the pump from the tank, a high-speed impeller throws the fuel outward in all directions at a high velocity. The high rotational speed swirls the fuel and produces a centrifuge action that separates air and vapor from the fuel.

15B-63 P07A

The type of fuel boost pump that separates air and vapor from the fuel before it enters the line to the carburetor is the

- A — gear type pump.
- B — centrifugal type pump.
- C — sliding vane type pump.

Answer B. JSAT 15-24 (AC65-9A)

The centrifugal type of boost pump uses a high-speed impeller to throw the fuel outward at a high velocity. The high rotational speed swirls the fuel and produces a centrifugal action that separates air and vapor from the fuel before it enters the fuel line to the carburetor.

15B-64 P07A

When routing a fuel line between two rigidly mounted fittings the line should

- A — have a flexible line added between two metal lines to allow for ease of installation.
- B — have at least one bend between such fittings.
- C — be a straight length of tubing and clamped to the aircraft structure.

Answer B. JSAT 15-22 (AC65-9A)

Rigid fuel lines flex and expand under pressure. All runs of tubing must have at least one bend between rigid fittings to absorb these strains.

SECTION C

FUEL SYSTEM REPAIR, TESTING, AND SERVICING

Section C of Chapter 15 contains information regarding fuel system maintenance practices including installations and repairs.

15C-1 P02A

Which procedure must be followed when defueling aircraft with sweptback wings?

- A — Defuel all the tanks at one time.
- B — Defuel the outboard wing tanks first.
- C — Defuel the inboard wing tanks first.

Answer B. JSAT 15-41

On a sweptback wing airplane, defueling procedures usually dictate that the outboard wing tanks be defueled first. If the inboard tanks are defueled first, the weight of the fuel in the outboard tanks can cause a rearward shift of the center of gravity that can cause the aircraft to tip back on to the tail.

15C-2 P02A

Fuel system components must be bonded and grounded in order to

- A — retard galvanic corrosion.
- B — drain off static charges.
- C — prevent stray currents.

Answer B. JSAT 15-36

To prevent unwanted potential buildups that increase the danger of a static electricity fire hazard, it is necessary to eliminate static electrical charges before they can build up and create a spark. To do this, all fuel system components must be bonded and grounded to dissipate static charges.

15C-3 P03A

Which of the following precautions is most important during refueling operations?

- A — Fuel to be used must be appropriately identified.
- B — All electrical switches must be in OFF position.
- C — All outside electrical sources must be disconnected from the aircraft.

Answer A. JSAT 15-39 (AC65-9A)

Care should be taken to identify the aviation fuel and lubricating oil dispensed from each refueling unit before beginning the actual servicing. Aviation technicians should be familiar with the various fuel grades and the gasoline requirements of the aircraft so that the appropriate fuel is used. The greatest single danger to aircraft safety from contaminated fuels cannot be attributed to solids, exotic microorganisms, surfactants, or even water. It is contamination resulting from human error. It is placing the wrong grade or type of fuel into an aircraft, mixing grades, or any other type of human error that allows placement of off-specification fuels aboard the aircraft.

15C-4 P03A

Before fueling an aircraft by using the pressure fueling method, what important precaution should be observed?

- A — The truck pump pressure must be adjusted for minimum filter pressure.
- B — The aircraft's electrical system must be on to indicate quantity gauge readings.
- C — The truck pump pressure must be correct for that refueling system.

Answer C. JSAT 15-41

When using pressure fueling under the wing, the technician must be sure that the pressure used and the delivery rate are those specified by the manufacturer of the aircraft.

15C-5 P03A

What flight safety related advantage does a pressure fueling system provide?

- A — Reduces the chances for fuel contamination.
- B — Keeps the aircraft within weight and balance limitations.
- C — Reduces the time required for fueling.

Answer A. JSAT 15-39 (AC65-9A)

Advantages of pressure fueling include reduction of aircraft skin damage caused by banging the aircraft with the fueling nozzle, reduced hazards to personnel, and reduced chance of fuel contamination.

15C-6 P03A

Aircraft pressure fueling systems instructional procedures are normally placarded on the

- A — lower wing surface adjacent to the access door.
- B — fuel control panel access door.
- C — aircraft ground connection point.

Answer B. JSAT 15-40 (AC65-9A)

Fueling and defueling procedures are normally placarded on the fueling control panel access door. In addition to knowing these procedures, the fueling operator should possess a thorough knowledge of the aircraft fuel system to recognize malfunction symptoms.

15C-7 P03A

Pressure fueling of aircraft is usually accomplished through

- A — at least one single point connection.
- B — individual fuel tank over wing and/or fuselage access points.
- C — pressure connections on individual fuel tanks.

Answer A. JSAT 15-40, JSAT 13-34

Pressure fueling is often accomplished through a single connection, often located under the wing.

15C-8 P04A

Which of the following may be used for the repair of fuel leaks on most integral fuel tanks?

- A — Riveting and resealing.
- B — Brazing and resealing.
- C — Welding and resealing.

Answer A. (AC43.13-1B)

Riveting in a patch plate is one method that may be used to repair integral fuel tanks. After riveting is complete, seal the seams with a compound that is insoluble in fuel.

15C-9 P04A

When inspecting a removable rigid fuel tank for leaks, what procedure should be followed?

- A — pressurize the tank with air and submerge in water to locate leaks.
- B — pressurize the tank with air and brush with soapy water.
- C — fill the tank with water and pressurize with air and brush with soapy water.

Answer B. (AC65-9A, FAR 23)

Fuel tanks are normally tested with air pressure inside the tank. Measure the pressure with an accurate gauge connected to the tank and maintain it with a good pressure regulator. As a safety feature, cover the filler opening by hand to be able to immediately release the pressure if there is any possibility of tank damage. Search for leaks with a soap and water solution, and check carefully around the repaired area and along every seam in the tank. FAR 23 identifies the test pressures that a fuel tank must be able to withstand.

15C-10 P04A

If it is necessary to enter an aircraft's fuel tank, which procedure should be avoided?

- A — Conduct the defueling and tank purging operation in an air conditioned building.
- B — Continue purging the tank during the entire work period.
- C — Station an assistant outside the fuel tank access to perform rescue operations if required.

Answer A. JSAT 15-41 (AC65-9A)

Never fuel or defuel an aircraft inside a hangar or in any area with inadequate ventilation and take all proper precautions with regard to neutralizing any static electricity that builds up when the fuel flows through the lines.

15C-11 P04A

What is the recommended practice for cleaning a fuel tank before welding?

- A — Steam clean the tank interior.
- B — Flush the inside of the tank with clean water.
- C — Purge the tank with air.

Answer A. JSAT 15-33 (AC65-9A)

Before welding, a fuel tank must be steamed for a minimum of 8 hours. This is done to remove all traces of fuel.

15C-12 P04A

Which gas is used for purging an aircraft fuel tank?

- A — Carbon monoxide.
- B — Helium or argon.
- C — Carbon dioxide.

Answer C. JSAT 15-34 (AC65-9A AC 43.13-1B)
When repairing an integral tank, drain and purge it with either argon or carbon dioxide until a vapor detector shows that the tank is free of explosive vapors and safe to repair. Both of these gases are heavier than air and will remain in the tank during the repair.

15C-13 P04A

Fuel leaks are usually classified as a stain, a seep, a heavy seep, or a running leak. As a general rule,

- A — stains, seeps, and heavy seeps are not flight hazards.
- B — all fuel leaks regardless of location or severity are considered a hazard to flight.
- C — stains, seeps, and heavy seeps, (in addition to running leaks) are considered flight hazards when located in unvented areas of the aircraft.

Answer C. JSAT 15-35

While leaks in integral tanks do not always constitute a flight hazard, any type of leak that allows fuel vapors to accumulate must be repaired before the aircraft is allowed to fly.

15C-14 P04A

The presence of fuel stains around a fuel nozzle would indicate

- A — clogged fuel nozzle.
- B — excessive airflow across the venturi.
- C — too much fuel pressure.

Answer A. JSPT 7-58

Injector nozzles do not require much service, but every 300 hours of operation they should be removed from the engine and checked. A clogged nozzle can be located by the presence of fuel dye stain on the cylinder head around the nozzle. Excessive airflow or too much fuel pressure would not cause fuel to pool around the base of the injector.

15C-15 P04A

What should be used to inert an integral fuel tank before attempting repairs?

- A — CO₂.
- B — Steam.
- C — Water.

Answer A. JSAT 15-34 (AC65-9A AC43.13-1B)
Carbon dioxide is the best thing to use to purge and inert an integral fuel tank before attempting to repair it.

15C-16 P04A

What should be used to remove flux from an aluminum tank after welded repairs?

- A — Soft brush and warm water.
- B — 5 percent solution of nitric or sulfuric acid.
- C — Mild solution of soap and warm water.

Answer B. (AC43.13-1B)

Many manufacturers recommend a 5 percent solution of nitric or sulfuric acid should be used to remove flux from an aluminum fuel tank after it has been weld repaired. The removal of the flux is especially important because of the possible corrosion it could cause.

15C-17 P05A

What must each fuel quantity indicator be calibrated to read during level flight when the quantity of fuel remaining is equal to the unusable fuel supply?

- A — Zero.
- B — Both the total unusable fuel quantity and the unusable fuel quantity in each tank.
- C — The total unusable fuel quantity.

Answer A. (FAR 23.1337b1)

Each fuel quantity indicator must be calibrated to read zero during level flight when the quantity of usable fuel remaining in the tank is equal to the unusable fuel supply.

15C-18 P06A

Which of the following is necessary to effectively troubleshoot a fuel pressure warning system?

- A — A set of Federal Aviation Regulations.
- B — The manufacturer's maintenance manuals.
- C — AC 43.13-1B, Acceptable Methods, Techniques, and Practices - Aircraft Inspection and Repair.

Answer B. JSAT 14-12 (AC65-9A)

To effectively troubleshoot an aircraft system, the manufacturer's maintenance or service manuals are needed. A manufacturer's maintenance manual is the primary reference tool for the aviation maintenance technician working on aircraft.

15C-19 P06A

Which of the following would be most useful to locate and troubleshoot an internal fuel leak in an aircraft fuel system?

- A — Illustrated parts manual.
- B — Aircraft structure repair manual.
- C — A fuel system schematic.

Answer C. (AC65-9A)

In order to become proficient at the art of troubleshooting, one must be familiar with the complete system which is being worked on. To do this, one can become familiar with the schematics of various portions of the system, the nomenclature of the units, and their particular function within the system by studying aircraft and engine maintenance manuals.

15C-20 P07A

If an aircraft is fueled from a truck or storage tank which is known to be uncontaminated with dirt or water, periodic checks of the aircraft's fuel tank sumps and system strainers

- A — are still necessary due to the possibility of contamination from other sources.
- B — can be eliminated except for the strainer check before the first flight of the day and the fuel tank sump check during 100-hour or annual inspections.
- C — can be sharply reduced since contamination from other sources is relatively unlikely and of little consequence in modern aircraft fuel systems.

Answer A. JSAT 15-37 (AC65-9A)

Even though a fuel tank is serviced with fuel that is known to be free of contamination, contamination of the fuel is still a possibility. Contaminants can come from a leaking fuel cap, a fuel cap left off the tank for a period of time, or corrosion from inside the tank. Periodic checks of the system sumps and strainers are necessary.

15C-21 P07A

Aircraft defueling should be accomplished

- A — with the aircraft's communication equipment on and in contact with the tower in case of fire.
- B — in a hangar where activities can be controlled.
- C — in the open air for good ventilation.

Answer C. JSAT 15-41 (AC65-9A)

Aircraft should be fueled and defueled in a safe place. Do not fuel or defuel an aircraft in a hangar or other enclosed space. This operation should take place on the ramp.

15C-22 P07A

The location of leaks and defects within the internal portions of the fuel system can usually be determined by

- A — observing the pressure gauge and operating the selector valves.
- B — visual inspection for evidence of wet spots and stains, and feeling for unusually warm components.
- C — performing a fuel flow check.

Answer A. JSAT 15-33 (AC65-9A)

The location of leaks and defects within the internal portions of the fuel system is usually a matter of observation of the pressure gage and operation of the selector valves to determine where the trouble lies. Without the engines running, the pressure gage should read a steady pressure. If the pressure fluctuates when a certain selector valve is opened, there is an indication of a leak in that part of the system.

15C-23 P07A

When inspecting a fuel system, you should check all valves located downstream of boost pumps with the pumps

- A — operating.
- B — dormant.
- C — at idle.

Answer A. JSAT 15-33 (AC 43.13-1B)

When checking fuel system valves for internal leakage, all valves located downstream of the boost pumps should be checked with the pumps operating. If a leak is present, it will be easier to detect when the valve is under pressure.

15C-24 P07A

- (1) On a large aircraft pressure refueling system, a pressure refueling receptacle and control panel will permit one person to fuel or defuel any or all fuel tanks of an aircraft.
- (2) Because of the fuel tank area, there are more advantages to a pressure fueling system in light aircraft.

Regarding the above statements,

- A — only No. 1 is true.
- B — both No. 1 and No. 2 are true.
- C — only No. 2 is true.

Answer A. JSAT 15-40 (AC65-9A)

Servicing from a single point has greatly reduced servicing time on large aircraft, as all tanks can be serviced in the proper order from a single refueling panel.

15C-25 P07A

Microbial growth is produced by various forms of micro organisms that live and multiply in the water interfaces of jet fuels. Which of the following could result if microbial growth exists in a jet fuel tank and is not corrected?

1. Interference with fuel flow.
2. Interference with fuel quantity indicators.
3. Engine seizure.
4. Electrolytic corrosive action in a metal tank.
5. Lower grade rating of the fuel.
6. Electrolytic corrosive action in a rubber tank.

A — 2, 3, and 5.

B — 1, 5, and 6.

C — 1, 2, and 4.

Answer C. (AC65-9A)

The buildup of microbial growth not only interferes with fuel flow and with fuel quantity indication, but it can also start electrolytic corrosive action in a metal tank.

15C-26 P07A

What can be done to eliminate or minimize the microbial growth problem in an aircraft jet fuel tank?

A — Use anti icing and antibacterial additives.

B — Keep the fuel tank topped off.

C — Add CO₂ as a purgative.

Answer A. JSAT 15-38

To eliminate or minimize the microbial growth in an aircraft jet fuel tank, anti-icing and antibacterial additives such as Prist are used.

15C-27 P07A

If a bladder type fuel tank is to be left empty for an extended period of time, the inside of the tank should be coated with a film of

A — ethylene glycol.

B — engine oil.

C — linseed oil.

Answer B. JSAT 15-34

If it is necessary to leave a bladder-type fuel tank empty, the inside of the tank should be wiped with a rag leaving a film of engine oil on its inside surface.

FIRE PROTECTION SYSTEMS

SECTION A FIRE DETECTION

Section A of Chapter 16 contains information regarding smoke, carbon monoxide, and fire detection systems. Regulatory fire resistance requirements are also contained in this section.

16A-1 D04A

Cabin upholstery materials installed in current standard category airplanes must

- A — meet the requirements prescribed in Part 43.
- B — be at least flame resistant.
- C — be fireproof.

Answer B. (FAR 23.853)

FAR 23.853(a) Passenger and Crew Compartment Interiors. For each compartment to be used by the crew or passengers, the materials must be at least flame resistant.

16A-2 T01A

In what area of an aircraft would you find a carbon monoxide detector?

- A — Engine and/or nacelle.
- B — Surface combustion heater compartment.
- C — Cockpit and/or cabin.

Answer C. JSAT 16-12 (AC65-15A)

Carbon Monoxide (CO) detectors are used to sense the presence of deadly carbon monoxide gas and are primarily found in aircraft cabins or cockpits.

16A-3 T01A

What occurs when a visual smoke detector is activated?

- A — A lamp within the indicator illuminates automatically.
- B — The test lamp illuminates and an alarm is provided automatically.
- C — A warning bell within the indicator alarms automatically.

Answer A. JSAT 16-11 (AC65-15A)

On a few aircraft, visual smoke detectors provide the only means of smoke detection. When smoke is present, the light from an internal lamp is reflected by the smoke and the light illuminates a panel within the indicator, indicating the presence of smoke.

16A-4 T01A

When air samples contain carbon monoxide, portable carbon monoxide detectors containing yellow silica gel will turn which color?

- A — Blue.
- B — Green.
- C — Red.

Answer B. JSAT 16-13 (AC65-15A)

There are several types of portable carbon monoxide testers in use. One type has a replaceable indicator tube that contains a yellow silica gel. During operation, a sample of air is drawn through the detector tube. When the air sample contains carbon monoxide, the yellow silica gel turns to a shade of green. The intensity of the green color is proportional to the concentration of carbon monoxide in the air sample at the time and location of the tests.

16A-5 T01A

Smoke detection instruments are classified by their method of

- A — detection.
- B — construction.
- C — maintenance.

Answer A. JSAT 16-11 (AC65-15A)

Smoke detection instruments are classified by method of detection, and, in some cases, an aircraft will have different types of detectors installed in various locations.

16A-6 T01A

Smoke detectors which use a measurement of light transmissibility in the air are called

- A — visual devices.
- B — electromechanical devices.
- C — photoelectrical devices.

Answer C. JSAT 16-11 (AC65-15A)

Photoelectric smoke detectors consist of a photoelectric cell, a beacon lamp, and a light trap, all mounted on a labyrinth. Air samples are drawn through the detector unit, usually by a small circulating fan. When smoke particles are present, they refract light into the photoelectric cell. An accumulation of 10% smoke in the air causes the photoelectric cell to conduct electric current. When activated by smoke, the detector supplies a signal to a smoke detector amplifier, which activates a warning light and aural warning.

16A-7 T01A

A contaminated carbon monoxide portable test unit would be returned to service by

- A — installing a new indicating element.
- B — evacuating the indicating element with CO₂.
- C — heating the indicating element to 300 °F to reactivate the chemical.

Answer A. JSAT 16-12 (AC65-15A)

The portable carbon monoxide tester which has the yellow silica gel is returned to service after contamination by replacing the tube which contains the gel.

16A-8 T01A

Which fire detection system measures temperature rise compared to a reference temperature?

- A — Lindberg continuous element.
- B — Fenwal continuous loop.
- C — Thermocouple.

Answer C. JSAT 16-6 (AC65-15A)

In a typical thermocouple system, one or more thermocouples, called active thermocouples are placed in fire zones around an engine while a separate thermocouple, called the reference thermocouple, is placed in a dead air space between two insulated blocks. Under normal operations, the temperature of the air surrounding the reference thermocouple and the active thermocouples are relatively even and no current is produced to activate a warning light. However, when a fire occurs, the air temperature around the active thermocouples rises much faster than the air temperature around the reference thermocouple. The difference in temperature produces a current in the thermocouple circuit and activates a warning light and horn. A thermocouple depends upon the rate of temperature rise and will not give a warning when an engine slowly overheats or a short circuit develops.

16A-9 T01A

Smoke in the cargo and/or baggage compartment of an aircraft is commonly detected by which instrument?

- A — Chemical reactor.
- B — Photoelectric cell.
- C — Sniffer.

Answer B. JSAT 16-11 (AC65-15A)
Photoelectric smoke detectors are most commonly used in aircraft cargo and baggage compartments.

16A-10 T01A

Light refraction smoke detectors

- A — sense light reflected from smoke particles passing through a chamber.
- B — use radiation induced ionization to detect the presence of smoke.
- C — measure a reduction in the amount of visible or infrared light in the surrounding area.

Answer A. JSAT 16-11

This type of detector consists of a photoelectric cell, a beacon lamp, and a light trap, all mounted on a labyrinth. Air samples are drawn through the detector unit, usually by a small circulating fan. When smoke particles are present, they refract light into the photoelectric cell. An accumulation of 10% smoke in the air causes the photoelectric cell to conduct electric current. When activated by smoke, the detector supplies a signal to a smoke detector amplifier, which activates a warning light and aural warning.

16A-11 T01A

Why does the Fenwal fire detection system use spot detectors wired parallel between two separate circuits?

- A — A short may exist in either circuit without causing a false fire warning.
- B — A control unit is used to isolate the bad system in case of malfunction.
- C — This installation is equal to two systems: a main system and a reserve system.

Answer A. JSAT 16-5 (AC65-15A)

The Fenwal fire detection system is wired in parallel between two separate circuits so an open or short in either leg of the system will not cause a false fire warning.

16A-12 T02A

The most common cause of false fire warnings in continuous loop fire detection systems is

- A — dents, kinks, or crushed sensor sections.
- B — moisture.
- C — improper routing or clamping of loops.

Answer A. JSAT 16-14 (AC65-15A)

In addition to checking for security, a continuous-loop-sensing element should be checked for dents, kinks, or crushed areas. If the tube becomes dented, kinked, or crushed, the circuit can be completed even though a fire is not present. Each manufacturer establishes the limits for acceptable dents or kinks as well as the minimum acceptable diameter for a sensing element. It is important to note that if a dent or kink exists that is within the manufacturer's limits, no attempt should be made to straighten it. Attempting to straighten a sensing element sets up stresses that could cause the tubing to fail.

16A-13 T02A

A thermocouple in a fire detection system causes the warning system to operate because

- A — heat decreases its electrical resistance.
- B — it expands when heated and forms a ground for the warning system.
- C — it generates a small current when heated.

Answer C. JSAT 16-6 (AC65-15A)

A thermocouple consists of a loop of two dissimilar metal wires such as chromel and constantan that are joined at each end to form two junctions. When a fire occurs, the air temperature around the active thermocouples rises much faster than the air temperature around the reference thermocouple. The difference in temperature produces a current in the thermocouple circuit and activates a warning light and horn.

16A-14 T02A

The thermocouple fire warning system is activated by a

- A — certain temperature.
- B — core resistance drop.
- C — rate of temperature rise.

Answer C. JSAT 16-6 (AC65-15A)

In a thermocouple system, the detectors are triggered by the rate of temperature rise rather than a preset temperature. In other words, when the temperature of the surrounding air rises too rapidly, a thermocouple detector initiates a fire warning. However, a thermocouple will not produce a warning when an engine slowly overheats or a short circuit develops.

16A-15 T02A

When used in fire detection systems having a single indicator light, thermal switches are wired in

- A — series with each other and parallel with the light.
- B — parallel with each other and in series with the light.
- C — series with each other and the light.

Answer B. JSAT 16-5 (AC65-15A)

In a fire detection system, thermal switches are generally wired in parallel with each other and in series with the warning light. By wiring the switches in parallel, an open in the parallel circuit will not affect the operation of the system. When one switch closes, a ground is provided for the circuit and the warning light illuminates.

16A-16 T02A

The thermal switches of a bimetallic thermal switch type fire detection system are heat sensitive units that complete circuits at a certain temperature. They are connected in

- A — series with each other, but in parallel with the indicator lights.
- B — parallel with each other, but in series with the indicator lights.
- C — parallel with each other, and in parallel with the indicator lights.

Answer B. JSAT 16-5 (AC65-15A)

Bimetallic thermal switches in fire detection systems are usually wired in parallel with each other and in series with the warning light. By wiring the switches in parallel, the system can withstand an open circuit in the thermal switch loop without affecting the ability of the switches to indicate a fire. A short circuit in the system, however, will trigger a false fire warning.

16A-17 T02A

Maintenance of fire detection systems includes the

- A — removal of excessive loop or element material.
- B — repair of damaged sensing elements.
- C — replacement of damaged sensing elements.

Answer C. (AC65-15A)

When performing maintenance on fire detection systems, damaged sensing elements are replaced and not repaired. Continuous loop elements come in pre-made lengths, so they are not altered in any way. Fire detection sensing elements are not calibrated or repaired by the maintenance technician.

SECTION B FIRE-EXTINGUISHING SYSTEMS

Section B of Chapter 16 contains information regarding fire-extinguishing system inspections and maintenance. Regulatory fire suppression requirements are also contained in this section.

16B-1 T01A

The types of fire extinguishing agents for aircraft interior fires are

- A — water, carbon dioxide, dry chemical, and halogenated hydrocarbons.
- B — water, dry chemical, methyl bromide, and chlorobromomethane.
- C — water, carbon tetrachloride, carbon dioxide, and dry chemical.

Answer A. JSAT 16-16, JSGT 13-9

Fire protection for the aircraft interior is usually provided by hand-held extinguishers. Four types of fire extinguishers are available for extinguishing interior fires: (1) water (2) carbon dioxide (3) dry chemical, and (4) halogenated hydrocarbons.

16B-2 T01A

A carbon dioxide (CO²) hand held fire extinguisher may be used on an electrical fire if the

- A — horn is nonmagnetic.
- B — horn is nonmetallic.
- C — handle is insulated.

Answer B. JSAT 16-16 (AC65-15A)

A carbon dioxide hand held fire extinguisher can be used on an electrical fire, provided the discharge horn is made from a nonmetallic material. A metallic horn would tend to transfer an electrical charge back to the fire extinguisher and to ground through the person holding the extinguisher.

16B-3 T01A

The proper fire extinguishing agent to use on an aircraft brake fire is

- A — dry powder chemical.
- B — water.
- C — carbon dioxide.

Answer A. JSGT 13-10 (AC65-9A)

Aircraft brake systems may utilize components made of magnesium, a highly flammable metal. Burning magnesium is considered a Class D fire. While the cause may be a Class A, B, or C fire, flammable metals must be extinguished with a special Dry Powder material. This material is not to be confused with the common Dry Chemical extinguisher.

16B-4 T02A

A fire extinguisher container can be checked to determine its charge by

- A — attaching a remote pressure gauge.
- B — weighing the container and its contents.
- C — a hydrostatic test.

Answer B. JSAT 16-22 (AC65-15A)

Once it has been determined that a bottle is properly charged by checking the pressure of the bottle using the pressure/temperature charts provided by the manufacturer, determine the appropriate amount of extinguishing agent by weighing the container.

16B-5 T02A

What is the color code for fire extinguisher lines?

- A — Brown.
- B — Yellow.
- C — Red and green.

Answer A. JSGT 10-13 (AC65-9A)

Large aircraft contain plumbing systems for many different types of fluids. Because of this, it is important that each line be clearly identified. This is generally accomplished by marking tubing with color bands, symbols, or writing. Color codes identify the fluid a line carries and warn of potential hazards. In the case of fire extinguishing lines, the color code is brown.

16B-6 T02A

Built-in aircraft fire-extinguishing systems are ordinarily charged with

- A — sodium bicarbonate and nitrogen.
- B — carbon dioxide and nitrogen.
- C — halogenated hydrocarbons and nitrogen

Answer C. JSAT 16-16 (AC65-15A)

Halogenated hydrocarbon, otherwise known as Halon, is extremely effective for extinguishing fires in engine compartments of both piston and turbine powered aircraft and is also considered to be one of the best extinguishing agents for aircraft interior fires. Halon bottles are charged with nitrogen to a pressure sufficient to ensure the complete discharge of the agent. Nitrogen is used as a pressurizing gas because it is inert and non-corrosive.

16B-7 T02A

In reference to aircraft fire extinguishing systems, (1) during removal or installation, the terminals of discharge cartridges should be grounded or shorted.

- (2) before connecting cartridge terminals to the electrical system, the system should be checked with a voltmeter to see that no voltage exists at the terminal connections.

Regarding the above statements,

- A — neither No. 1 nor No. 2 is true.
- B — both No. 1 and No. 2 are true.
- C — only No. 2 is true.

Answer B. JSAT 16-23

Because fire extinguisher discharge cartridges contain explosive material, extreme care must be taken to prevent inadvertent discharge. The terminal should be shorted any time that the unit is not in place, and there should be no voltage at the terminal connections when the cartridge is reinstalled.

16B-8 T02A

What method is used to detect the thermal discharge of a built in fire extinguisher system?

- A — A discoloring of the yellow plastic disk in the thermal discharge line.
- B — A rupture of the red plastic disk in the thermal discharge line.
- C — The thermal plug missing from the side of the bottle.

Answer B. JSAT 16-20 (AC65-15A)

As a safety feature, each extinguishing container is equipped with a thermal fuse that melts and releases the extinguishing agent if the bottle is subjected to high temperatures. If a bottle is emptied in this way, the extinguishing agent will blow out a red indicator disk as it vents to the atmosphere.

16B-9 T02A

On a periodic check of fire extinguisher containers, the pressure was not between minimum and maximum limits. What procedure should be followed?

- A — Release pressure if above limits.
- B — Replace the extinguisher container.
- C — Increase pressure if below limits.

Answer B. JSAT 16-22 (AC65-15A)

Aircraft service manuals contain pressure/temperature graphs or charts that provide the permissible gauge readings corrected for temperature. If the pressure does not fall within the appropriate limits, the container must be removed and replaced with a properly charged container.

16B-10 T02A

In some fire extinguishing systems, evidence that the system has been intentionally discharged is indicated by the absence of a

- A — red disk on the side of the fuselage.
- B — yellow disk on the side of the fuselage.
- C — green disk on the side of the fuselage.

Answer B. JSAT 16-20 (AC65-15A)

If a fire-bottle is discharged intentionally, a yellow indicator disk blows out. Like a conventional system, the indicator disks are visible from the outside of the fuselage for easy reference.

16B-11 T02A

If a fire extinguisher cartridge is removed from a discharge valve for any reason, it

- A — cannot be used again.
- B — must be pressure checked.
- C — is recommended that the cartridge be used only on the original discharge valve assembly

Answer C. JSAT 16-22 (AC65-15A)

If a discharge cartridge is removed from a bonnet assembly, it should not be used in another assembly because the distance the contact point protrudes may vary with each unit.

16B-12 T02A

Which of the following are fire precautions which must be observed when working on an oxygen system?

1. Display "No Smoking placards.
2. Provide adequate firefighting equipment.
3. Keep all tools and oxygen servicing equipment free from oil or grease.
4. Avoid checking aircraft radio or electrical systems.

A — 1, 3, and 4.

B — 1, 2, 3, and 4.

C — 1, 2, and 4.

Answer B. (AC65-15A)

When working on an oxygen system, it is essential that the warnings and precautions given in the aircraft maintenance manual be carefully observed. In general, before any work is attempted on an oxygen system, the following fire precautions should be taken: 1. Display "NO SMOKING" placards. 2. Provide adequate firefighting equipment. 3. Keep all tools and oxygen servicing equipment free from oil or grease. 4. Avoid checking aircraft radio or electrical systems.

16B-13 T02A

Which fire extinguishing agent is considered to be the least toxic?

- A — Bromochloromethane (Halon 1011).
- B — Carbon dioxide.
- C — Bromotrifluoromethane (Halon 1301).

Answer C. JSAT 16-16 (AC65-9A)
Bromotrifluoromethane (Halon 1301) is one of the most effective Halogenated hydrocarbon fire extinguishing agents. It is non-toxic at room temperature and does not promote corrosion. While carbon dioxide is also an effective fire extinguishing agent, it is considered to be slightly toxic, but non-corrosive. Halon 1011 is also a common fire extinguishing agent, but it is relatively toxic at room temperatures and is corrosive to aluminum and magnesium.

16B-14 T02A

A squib, as used in a fire protection system, is a

- A — temperature sensing device.
- B — probe used for installing frangible disks in extinguisher bottles.
- C — device for causing the fire extinguishing agent to be released.

Answer C. JSAT 16-20
The bonnet assembly of an HRD system contains an electrically ignited discharge cartridge, or squib, which fires a projectile into the frangible disk. Once the disk breaks, the pressurized nitrogen forces the extinguishing agent out of the sphere.

16B-15 T02A

(Refer to Airframe figure 21) Using the chart, determine the temperature range for a fire extinguishing agent storage container with a pressure of 330 PSIG. (Consider 330 PSIG for both minimum and maximum pressure.)

- A — 47° to 71°F.
- B — 47° to 73°F.
- C — 45° to 73°F.

Answer C. JSAT 16-22 (AC65-15A)
To find the temperature range for a container with a pressure of 330 PSIG, you must extrapolate the temperatures for both the minimum and maximum pressure values.

1. In each PSIG column, find the pressure range within which 330 PSIG falls then subtract the smaller number from the larger. In the minimum column, 330 falls between 319 and 356 and between 317 and 342 in the maximum column.

$$\text{Min: } 356 - 319 = 37 \text{ PSIG}$$

$$\text{Max: } 342 - 317 = 25 \text{ PSIG}$$

2. In the temperature column, the temperatures are shown in 10° increments. Divide the temperature range by the pressure resultant to determine the number of degrees/1 PSIG.

$$\text{Min: } 10^\circ \div 37 \text{ PSIG} = .27027^\circ/\text{PSIG}$$

$$\text{Min: } 10^\circ \div 25 \text{ PSIG} = .4^\circ/\text{PSIG}$$

3. Find the pressure difference between the given 330 PSIG and the minimum pressure value for both the minimum and maximum pressure ranges. Then multiply the resultant by the temperature/PSIG values found in step #2.

$$\text{Min: } 330 \text{ PSIG} - 319 \text{ PSIG} = 11 \text{ PSIG}$$

$$\text{Max: } 330 \text{ PSIG} - 317 \text{ PSIG} = 23 \text{ PSIG}$$

$$\text{Min: } 11 \text{ PSIG} \times .27027^\circ/\text{PSIG} = 2.97^\circ$$

$$\text{Max: } 13 \text{ PSIG} \times .4^\circ/\text{PSIG} = 5.2^\circ$$

4. Add the temperature resultants found in #3 to the minimum and maximum temperature ranges to determine the final temperature range for the fire extinguisher container.

$$\text{Min: } 2.97^\circ + 70^\circ = 72.97^\circ$$

$$\text{Max: } 5.2^\circ + 40^\circ = 45.2^\circ$$

16B-16 T02A

(Refer to Airframe figure 21) Determine what pressure is acceptable for a fire extinguisher when the surrounding area temperature is 33°F.

(Rounded to the nearest whole number.)

A — 215 to 302 PSIG.

B — 214 to 301 PSIG.

C — 215 to 301 PSIG.

Answer A. JSAT 16-22 (AC65-15A)

To answer this question, it is necessary to interpret the chart. For a temperature of 33°F, the allowable minimum pressure range is 209 PSIG to 230 PSIG, a difference of 21 PSIG, while the allowable maximum pressure range is 295 PSIG to 317 PSIG, a difference of 22 PSIG. Because our temperature is 33°F, our allowable pressures will be 3/10 of the way between the minimum and maximum pressure values for a given temperature range. For the minimum pressure range, three-tenths of 21 is 6.3 PSIG. This value, added to 209, gives us a lower limit of 215.3 PSIG. For the maximum pressure range, three-tenths of 22 is 6.6 PSIG, which, when added to 295 PSIG gives us an upper limit of 301.6 PSIG.

CONTAINER PRESSURE VERSUS TEMPERATURE		
TEMPERATURE °F	CONTAINER PRESSURE (PSIG)	
	MINIMUM	MAXIMUM
-40	60	145
-30	83	165
-20	105	188
-10	125	210
0	145	230
10	167	252
20	188	275
30	209	295
40	230	317
50	255	342
60	284	370
70	319	405
80	356	443
90	395	483
100	438	523

Figure 21. — Fire Extinguisher Chart

AIRCRAFT AIRWORTHINESS INSPECTION

SECTION A REQUIRED AIRWORTHINESS INSPECTIONS

This section contains information related to aircraft airworthiness inspection requirements and airman certificate requirements for individuals performing airworthiness inspections.

17A-1 G01A

Which statement is correct regarding an aircraft that is found to be unairworthy after an annual inspection, due to an item requiring a major repair (assuming approved data is used to accomplish the repair)?

- A — An appropriately rated mechanic may accomplish the repair, and an IA may approve the aircraft for return to service.
- B — Only the person who performed the annual inspection may approve the aircraft for return to service, after the major repair.
- C — An appropriately rated mechanic or repair station may repair the defect and approve the aircraft for return to service.

Answer A. JSAT 17-5

When an annual inspection is performed and the aircraft is found to be unairworthy, the owner is supplied with a list of the discrepancies. An A&P mechanic, with the necessary experience, tools, and tech data, may correct the discrepancies provided that they do not involve instrument repair or major repair to propellers. If the corrective action does involve a major repair to some other part of the aircraft, however, the A&P cannot approve the aircraft for return to service.

17A-2 G01A

An aircraft that is required by Section 91.409, to have a 100-hour inspection may be flown beyond the inspection requirement

- A — if necessary to reach a place at which the inspection can be accomplished, but not to exceed 10 flight hours.
- B — if necessary to reach a place at which the inspection can be accomplished, but a special flight permit is necessary.
- C — if necessary to reach a place at which the inspection can be accomplished, but not to exceed 15 flight hours.

Answer A. JSAT 17-5

In the case of a 100-hour inspection, the time limitation may be exceeded by no more than 10 hours of flight operation while enroute to an inspection facility. However, the excess time used to reach the inspection location must be included in computing the next 100 hours of time in service. For example, if a 100-hour inspection was due at 1000 hours and the pilot over-flew the aircraft to 1008 hours to reach an inspection facility, the next 100-hour inspection is still due at 1100 hours of operation.

17A-3 G01A

The maximum time a 100-hour inspection may be extended is

- A — 10 hours.
- B — 10 hours with a special flight permit.
- C — 12 hours with a special flight permit.

Answer A. JSAT 17-5

The 100-hour inspection may be exceeded by not more than 10 hours if necessary to reach a place at which the inspection can be done. The excess time, however, is included in computing the next 100 hours of time in service.

17A-4 G01A

Which statement is correct when an aircraft has not been approved for return to service after an annual inspection because of several items requiring minor repair?

- A — Only the person who performed the annual inspection may approve the aircraft for return to service.
- B — An appropriately rated mechanic may repair the defects, but an IA must approve the aircraft for return to service.
- C — An appropriately rated mechanic may repair the defects and approve the aircraft for return to service.

Answer C. JSAT 17-5

If an annual inspection is performed and not approved for return to service, the owner of the airplane is supplied with a list of the discrepancies. Providing the discrepancies are minor repair items, an A&P mechanic with the necessary experience, tools, and technical data is authorized to correct the discrepancies and approve the aircraft for return to service.

17A-5 G01A

An aircraft that is due an annual inspection may be flown

- A — for the purpose of performing maintenance.
- B — for a period of time not to exceed 10 hours.
- C — if a special permit has been issued for the aircraft.

Answer C. JSAT 17-5

An aircraft that is due for an annual inspection may not be operated unless a special flight permit has been issued. This certificate, often called a ferry permit, may be issued so that the aircraft can be flown to an appropriate maintenance facility where the annual inspection will be performed.

17A-6 G01A

For an individual (not a repair station) to conduct a complete 100-hour inspection on an aircraft and approve it for return to service requires a mechanic certificate with an

- A — airframe rating only.
- B — airframe and power plant ratings with an inspection authorization.
- C — airframe and power plant ratings.

Answer C. JSAT 17-5

An A&P technician may conduct the 100-hour inspection and approve the aircraft for return to service. The A&P technician who inspected the aircraft must make the proper entries in the aircraft's maintenance records and approve the aircraft for return to service before the 100-hour inspection is considered complete.

17A-7 G01A

Where would you find the operating conditions that make a 100-hour inspection mandatory?

- A — 14 CFR part 91.
- B — 14 CFR part 43.
- C — AC 43.13-2A.

Answer A. JSAT 17-2 (FAR 91.409b)

No person may operate an aircraft carrying any person (other than a crewmember) for hire, and no person may give flight instruction for hire in an aircraft which that person provides, unless within the preceding 100 hours of time in service the aircraft has received an annual or 100-hour inspection and been approved for return to service in accordance with FAR part 43, or has received an inspection for the issuance of an airworthiness certificate.

17A-8 G01A

Large airplanes and turbine-powered multiengine airplanes operated under Federal Aviation Regulation Part 91, General Operating and Flight Rules, must be inspected

- A — in accordance with a continuous airworthiness maintenance program (camp program) authorized under Federal Aviation Regulation Part 91, Subpart E.
- B — in accordance with the progressive inspection requirements of Federal Aviation Regulation Section 91.409(d).
- C — in accordance with an inspection program authorized under Federal Aviation Regulation Part 91, Subpart E.

Answer C. JSAT 17-2 (FAR 91.409)

FAR part 91.409(e) outlines that large and turbine powered, multi-engine aircraft require more specific detailed inspections that are tailored to their particular flight operations.

SECTION B

INSPECTION GUIDELINES AND PROCEDURES

Section B of Chapter 17 includes information regarding directive and guidance materials for the conduct of inspections on aircraft.

17B-1 G01A

Which statement about Airworthiness Directives (AD's) is true?

- A — Compliance with an AD is not mandatory unless the aircraft affected is for hire.
- B — AD's are information alert bulletins issued by the airframe, power plant, or component manufacturer.
- C — Compliance with an applicable AD is mandatory and must be recorded in the maintenance records.

Answer C. JSAT 17-26, JSAT 17-46 (AC65-9A)
Airworthiness directives (AD) are issued by the FAA to correct unsafe conditions that affect the safety of an aircraft. ADs are mandatory and require compliance. When airworthiness directives are accomplished, maintenance personnel are required to include the completion date, name of the person complying with the AD, signature, certificate number, and kind of certificate held by the person approving the work, and the current status of the applicable "AD" in the maintenance record entry.

SECTION C

AIRCRAFT MAINTENANCE RECORDS

Section C of Chapter 18 contains information regarding maintenance record entries for returning an aircraft to service after required airworthiness inspections.

17C-1 G01A

When overhauling electrical equipment, all necessary information should be obtained from

- A — illustrated parts manual for the aircraft.
- B — maintenance instructions published by the aircraft and/or equipment manufacturer.
- C — the aircraft maintenance manual.

Answer B. JSGT 14-15 (AC65-9A)

When working on electrical equipment, whether it involves repair or overhaul, the manufacturer's technical data should always be used. A manufacturer's maintenance manual is the primary reference tool for the aviation maintenance technician working on aircraft. Maintenance information presented in these manuals is considered acceptable data by the FAA, and may be approved data for the purpose of major repairs and alterations, and overhauls.

17C-2 G01A

Radio equipment installations made in accordance with Supplemental Type Certificate data require approval for return to service

- A — by an airframe and power plant mechanic.
- B — by the holder of an inspection authorization.
- C — by a field approval from the FAA.

Answer B. JSGT 14-12, JSGT 15-4

Supplemental Type Certificates are issued by the FAA when someone proposes and gets approval for a change to a Type Certificated Product (aircraft, aircraft engine, propeller). When a change is made in accordance with a Supplemental Type Certificate, it is considered to be a major alteration, and an FAA Form 337 must be filled out. The form 337 must then be approved by a holder of an inspection authorization.

17C-3 G01A

Where would you find the recommended statement for recording the approval or disapproval for return to service of an aircraft after a 100-hour or annual inspection?

- A — 14 CFR Part 65.
- B — 14 CFR Part 43.
- C — 14 CFR Part 91.

Answer B. JSAT 17-44

In FAR 43.11, the suggested wording is given for the approval or disapproval for return to service after a 100-hour inspection.

17C-4 D04A

If a new safety belt is to be installed in an aircraft, the belt must conform to the strength requirements in which document?

- A — TSO C22.
- B — FAR Part 39.
- C — STC 1282.

Answer A. JSGT 14-3

The standards which safety belts must meet are contained in Technical Standard Order C22. The Technical Standard Order System is covered in FAR 21, Subpart O, TSO, C22. FAR Part 39 is incorrect because it has to do with Airworthiness Directives. STC 1282 is wrong since conformity with a standard has little to do with a Supplemental Type Certificate that is aircraft specific.

APPENDIX

A

SUBJECT MATTER KNOWLEDGE CODES

The publications listed in the following pages contain study material you need to be familiar with when preparing for aviation mechanic knowledge tests. These publications can be purchased through the U.S. Government Printing Office (GPO), commercial aviation supply houses, or industry organizations. The latest revision of the listed references should be requested. Additional study material is also available through these sources that may be helpful in preparing for aviation mechanic knowledge tests. All publications listed would be excellent for a mechanic to have in a personal reference library.

AVIATION MECHANIC—AIRFRAME ABBREVIATIONS AND REFERENCES

Wood Structures—AC 65-15A, AC 43.13-1B, MR

- 01 Service and repair wood structures
- 02 Identify wood defects
- 03 Inspect wood structures

Aircraft Covering—AC 65-15A, AC 43.13-1B, MR

- 01 Select and apply fabric and fiberglass covering materials
- 02 Inspect, test, and repair fabric and fiberglass

Aircraft Finishes—AC 65-15A, AC 43.13-1B, MR, JSAT

- 01 Apply trim, letters, and touchup paint
- 02 Identify and select aircraft finishing materials
- 03 Apply finishing materials
- 04 Inspect finishes and identify defects

Sheet Metal and Non-Metallic Structures—AC 65-9A, AC 65-15A, AC 43.13-1B, 14 CFR part 23, 30, AMR, AComp, ABStruc, JSGT, JSAT

- 01 Select, install, and remove special fasteners for metallic, bonded, and composite structures
- 02 Inspect bonded structures
- 03 Inspect, test, and repair fiberglass, plastics, honeycomb, composite, and laminated primary and secondary structures

- D04 Inspect, check, service, and repair windows, doors, and interior furnishings
- D05 Inspect and repair sheet-metal structures
- D06 Install conventional rivets
- D07 Form, lay out, and bend sheet metal

Welding—AC 65-15A, AC 43.13-1B, AMR, WG, JSAT

- E01 Weld magnesium and titanium
- E02 Solder stainless steel
- E03 Fabricate tubular structures
- E04 Solder, braze, gas-, and arc-weld steel
- E05 Weld aluminum and stainless steel

Assembly and Rigging—AC 65-9A, AC 65-15A, AC 61-13B, AC 43.13-1B & 2A, 14 CFR part 23, AMR, JSAT

- F01 Rig rotary-wing aircraft
- F02 Rig fixed-wing aircraft
- F03 Check alignment of structures
- F04 Assemble aircraft components, including flight control surfaces
- F05 Balance, rig, and inspect movable primary and secondary flight control surfaces
- F06 Jack aircraft

AC 60-25G 5/12/05 Airframe Inspection—AC 65-9A, 14 CFR part 43, 14 CFR part 65, 14 CFR part 91

- G01 Perform airframe conformity and airworthiness inspections
- HXX Reserved
- IXX Reserved
- JXX Reserved

Aircraft Landing Gear Systems—AC 65-9A, AC 65-15A, AC 43.13-1B, 14 CFR part 43, AMR, AHS, JSAT

- K01 Inspect, check, service, and repair landing gear, retraction systems, shock struts, brakes, wheels, tires, and steering systems

Hydraulic and Pneumatic Power Systems—AC 65-9A, AC 65-15A, AMR, AHS, JSAT, AMT-A

- L01 Repair hydraulic and pneumatic power system components
- L02 Identify and select hydraulic fluids
- L03 Inspect, check, service, troubleshoot, and repair hydraulic and pneumatic power systems

Cabin Atmosphere Control Systems—AC 65-15A, AC 43.13-1B, AMR, AAC, JSAT, 49 CFR part 173

- M01 Inspect, check, service, troubleshoot, and repair heating, cooling, air-conditioning, pressurization, and air cycle machines
- M02 Inspect, check, troubleshoot, service, and repair oxygen systems

Aircraft Instrument Systems—AC 65-9A, AC 65-15A, 14 CFR part 23, 14 CFR part 65, 14 CFR part 91, AEE, AMR, AMT-A, JSAT

- N01 Inspect, check, service, troubleshoot, and repair electronic flight instrument systems and both mechanical and electrical heading, speed, altitude, temperature, pressure, and position indicating systems to include the use of built-in test equipment
- N02 Install instruments and perform a static pressure system leak test

Communication and Navigation Systems—AC 65-15A, AC 91-44A, AC 43.13-2A, AEE, AP, ARS, JSAT, 47 CFR § 87.89

- O01 Inspect, check, and troubleshoot autopilot, servos and approach coupling systems
- O02 Inspect, check, and service aircraft electronic communication and navigation systems, including VHF, passenger address interphones and static discharge devices, aircraft VOR, ILS, LORAN, radar beacon transponders, flight management computers, and GPWS
- O03 Inspect and repair antenna and electronic equipment installations

Aircraft Fuel Systems—AC 65-9A, AC 65-12A,

AC 65-15A, AC 43.13-1B & 2A, 14 CFR part 23, 14 CFR part 25, AMR, MMM, FMS, JSGT, JSAT

- P01 Check and service fuel dump systems
- P02 Perform fuel management, transfer, and defueling
- P03 Inspect, check, and repair pressure fueling systems
- P04 Repair aircraft fuel system components
- P05 Inspect and repair fluid quantity indicating systems
- P06 Troubleshoot, service, and repair fluid pressure and temperature warning systems
- P07 Inspect, check, service, troubleshoot, and repair aircraft fuel systems

Aircraft Electrical Systems—AC 65-9A, AC 65-15A, AC 43.13-1B & 2A, 14 CFR part 23, AEE, MBM, JSGT, JSAT

- Q01 Repair and inspect aircraft electrical system components; crimp and splice wiring to manufacturer's specifications; and repair pins and sockets of aircraft connectors
- Q02 Install, check, and service airframe electrical wiring, controls, switches, indicators, and protective devices
- Q03 Inspect, check, troubleshoot, service, and repair alternating and direct current electrical systems
- Q04 Inspect, check, and troubleshoot constant speed and integrated speed drive generators

Position and Warning Systems—AC 65-9A, AC 65-15A, AC 43.13-1B, 14 CFR part 23, AMR, AMT-A, JSAT

- R01 Inspect, check, and service speed and configuration warning systems, electrical brake controls, and antiskid systems
- R02 Inspect, check, troubleshoot, and service landing gear position indicating and warning systems

Ice and Rain Control Systems—AC 65-15A, AMT-A

- S01 Inspect, check, troubleshoot, service, and repair airframe ice and rain control systems

Fire Protection Systems—AC 65-9A, AC 65-15A, AP, JSAT

- T01 Inspect, check, and service smoke and carbon monoxide detection systems
- T02 Inspect, check, service, troubleshoot, and repair aircraft fire detection and extinguishing systems

NOTE: AC 00-2, Advisory Circular Checklist, transmits the status of all FAA advisory circulars (AC's), as well as FAA internal publications and miscellaneous flight information such as Aeronautical Information Manual (AIM), Airport/Facility Directory, knowledge test study guides, and other material directly related to a certificate or rating. The checklist is available on the internet at:

http://www.faa.gov/aba/html_policies/ac00_2.html

Subject Matter Knowledge Code Cross-Reference Guide

Use this list to find the Jeppesen question numbers for FAA Subject Matter Knowledge Codes.

A01A	3A-1	3B-7	2C-10	E01A	4A-1	1B-9
	3A-2	3B-8	2C-11		4B-1	1B-10
	3A-3	3B-9	2C-12		4B-2	1B-11
	3A-4	3B-10	2C-13			1B-12
A02A	3A-5	3B-11	2D-2	E02A	4A-2	1B-13
	3A-6	D03A	2D-3		4A-3	1B-14
	3A-7	3B-12	2D-4	E03A	4B-3	1B-15
	3A-8	3B-13	2D-5		4B-4	1B-16
	3A-9	3B-14	2D-6	E04A	4A-4	1B-17
	3A-10	3B-15	3A-16		4A-5	1B-18
A03A	3A-11	3B-16			4A-6	1B-19
	3A-12	3B-17	D06A		4A-7	1B-20
	3A-13	3B-18	2A-5		4A-8	F03A
	3A-14	3B-19	2A-6		4B-5	1A-10
B01A	5A-1	3B-20	2A-7		4B-6	1A-11
	5A-2	3B-21	2A-8		4C-1	1B-21
	5B-1	3B-22	2A-9		4C-2	1B-22
	5B-2	3B-23	2A-10		4C-3	1B-23
	5B-3	3B-24	2B-17		4C-4	1B-24
B02A	5A-3	3B-25	2B-18		4C-5	F04A
	5A-4	3B-26	2B-19		4C-6	1B-25
	5B-4	3B-27	2B-20			1B-26
	5B-5	3B-28	2B-21	E05A	2A-12	1B-27
	5B-6	3B-29	2B-22		4A-9	1B-28
	5C-1	3B-30	2B-23		4A-10	1B-29
C01A	6C-1	3B-31	2B-24		4A-11	1B-30
	6C-2	3B-32	2B-25		4A-12	1B-31
C02A	6B-1	3B-33	2B-26		4A-13	1B-32
	6B-2	3B-34	2B-27		4A-14	F05A
	6B-3	3B-35	2B-28		4B-7	1B-33
	6B-4	3C-1	2B-29		4C-7	1B-34
	6B-5	D04A	2C-14		4C-8	1B-35
C03A	6A-1	3C-2	2C-15		4C-9	1B-36
	6B-6	3C-3	2C-16		4C-10	1B-37
	6B-7	3C-4	2C-17		4C-11	1B-38
	6B-8	3C-5	2C-18	F01A	1A-5	1B-39
	6B-9	3C-6	2C-19		1C-1	1B-40
C04A	6A-2	3C-7	2C-20		1C-2	1B-41
	6A-3	D04A	2C-21		1C-3	1B-42
	6B-10	16A-1	D07A		1C-4	1B-43
D01A	2B-1	17C-4	2A-1		1C-5	1B-44
	2B-2	D05A	2A-11		1C-6	1B-45
	2B-3	1A-1	2C-22		1C-7	1B-46
	2B-4	1A-2	2C-23		1C-8	1B-47
	2B-5	1A-3	2C-24		1C-9	1B-48
	2B-6	1A-4	2C-25		1C-10	1B-49
	2B-7	2A-2	2C-26		1C-11	1B-50
	2B-8	2A-3	2C-27		1C-12	1B-51
	2C-1	2A-4	2C-28		1C-13	1B-52
	2C-2	2B-9	2C-29		1C-14	1B-53
	2C-3	2B-10	2C-30			1B-54
	3B-1	2B-11	2C-31	F02A	1A-6	1B-55
	3B-2	2B-12	2C-32		1A-7	1B-56
J02A	2D-1	2B-13	2C-33		1A-8	1B-57
	3A-15	2B-14	2C-34		1A-9	1B-58
	3B-3	2B-15	2C-35		1B-1	F06A
	3B-4	2B-16	2C-36		1B-2	1B-59
	3B-5	2C-4	2C-37		1B-3	1B-60
	3B-6	2C-5	2C-38		1B-4	G01A
		2C-6	2C-39		1B-5	17A-1
		2C-7	2C-40		1B-6	17A-2
		2C-8	2C-41		1B-7	17A-3
		2C-9			1B-8	17A-4
						17A-5
						17A-6

17A-7	9B-18	8B-24	8C-60	14C-30
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9A-4	9C-9	8B-38	14B-11	14B-35
9A-5	9C-10	8B-39	14B-12	14B-36
9A-6	9C-11	8B-40	14B-13	14B-37
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9A-28	8C-16	8C-39	14C-9	11A-12
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9B-6	8B-12	8C-48	14C-18	11A-22
9B-7	8B-13	8C-49	14C-19	11A-23
9B-8	8B-14	8C-50	14C-20	11A-24
9B-9	8B-15	8C-51	14C-21	11A-25
9B-10	8B-16	8C-52	14C-22	11A-26
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9B-15	8B-21	8C-57	14C-27	11B-4
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	10B-13	16B-11
	10B-14	16B-12
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APPENDIX

B

AIRFRAME ORAL AND PRACTICAL EXAM STUDY GUIDE

This appendix of the Airframe Study Guide has been developed to aid you in preparing for the FAA Airframe Mechanic Oral and Practical Exam. The appendix provides information in three areas. The first area provides helpful suggestions on how applicants from Aviation Maintenance Technician Schools (AMTS), the military, or persons applying for certification through occupational experience can best prepare, apply for, and take the exam.

The second area of the appendix includes sample oral exam questions and answers, divided by subject area. These are typical questions that an examiner is likely to ask during testing. It should be noted that, since the FAA allows AMEs the flexibility to create their own Oral questions and answers, it is impossible for this or any study guide to provide the exact questions that the examiner will use. However, if you understand these questions, you should be adequately prepared to pass the test. The answers to the questions are provided along with references that can be used as an additional source of study material concerning each question.

The final part of this appendix includes sample practical projects that an examiner may assign during your test. Since the testing facilities and equipment vary between examiners, it is impossible to cover all the projects that you may be tested on. However, if you are able to perform the sample projects presented in this test guide, you should be adequately prepared to pass the FAA Practical Exam. The projects are divided into subject areas and follow the corresponding Oral questions.

The practical projects also include a skill level that must be reached in order to satisfactorily complete the projects. The completion standards are:

Projects that require Level 1 skills are accomplished by your showing or explaining basic principles without using any manipulative skills.

Level 2 projects require you to have knowledge of general principles, and you must demonstrate limited practical application. For these projects, you will likely be required to demonstrate sufficient manipulative skills to perform basic operations.

Level 3 projects require you to have a high degree of knowledge of general principles and to demonstrate a high degree of practical application. To complete Level 3 projects satisfactorily, you are required to demonstrate the ability to complete the project to simulate a return-to-service condition.

Finally, each project includes a list of materials that the examiner will make available for you to use to complete the project. The examiner must provide you with access to current publications, and also will provide you with special tools and equipment. However, you should verify what tools you will be required to provide when you schedule the test. In most cases, you will at least need basic hand tools, including an inspection mirror(s), flashlight, sockets with ratchets, screwdrivers, wrenches, and safety equipment.

Requirements For Certification

The requirements for the certification of aircraft mechanics are outlined in Title 14 of the Code of Federal Regulations (14 CFR, Part 65)

Eligibility Requirements

To be eligible for a mechanic certificate, a person must:

1. Be at least 18 years of age.
2. Be able to read, write, speak, and understand the English language (unless the applicant is to be employed outside the United States by a U.S. air carrier, in which case the certificate will have a limitation to be effective only outside the United States).
3. Have passed all of the prescribed Airman Knowledge Exams within a period of 24 calendar months. If the application is for an original issuance for a mechanic certificate, depending on the rating sought, you must have passed the General and Airframe Knowledge Exams, or General and Powerplant Knowledge Exams, within 24 calendar months of taking the Oral and Practical Exams.
4. Comply with other applicable regulations of Part 65 as detailed below.

Experience and Application Requirements

There are two ways in which an applicant may meet the FAA requirements to be eligible to obtain a Mechanic Certificate.

The first way is to present a certificate of completion from an Aviation Maintenance Technician School (AMTS) to an examiner that is affiliated with the school. If you take the Airman Knowledge, Oral, or Practical Exams with an examiner that is affiliated with your AMTS, the school will provide two copies of FAA Form 8610-2 (Airman Certificate and/or Rating Application), and authorize you to take the required tests. If you are a graduate of an AMTS and wish to complete the Airman Knowledge or Oral and Practical Exams at a facility other than the AMTS that you attended, you must go to an FAA FSDO to have an Airworthiness Inspector authorize you to take the tests. At that time, the inspector will have you fill out two copies of the FAA Form 8610-2 and will ask you for a photo identification. Before you can begin any FAA required tests, you must present both forms with original signatures and photo identification. **DO NOT LOSE THE FORMS** and do not allow the Airman Knowledge Testing Center personnel to keep either of the originals (although they may make a photocopy for their records).

The second way to qualify for an Airman Mechanic Certificate is to present the FAA with documentary evidence showing work or military experience applicable to the rating(s) sought. This documentation should include descriptions of the work showing that the procedures, practices, materials, and equipment generally used in constructing, maintaining, or altering airframes or powerplants has been obtained. It is helpful if the documentation includes a contact phone number for a person that served in a supervisory position in case the FAA inspector needs further verification. For applicants with military experience, military discharge Form DD-214 may be used along with any training certificates received during military service. Part 65 requires a minimum of 18 months experience maintaining airframes to qualify for the Airframe Rating, or 30 months combined experience maintaining airframes and powerplants to qualify for both an Airframe and Powerplant rating. The work experience should essentially reflect the equivalent of a forty-hour workweek, although the work does not need to be consecutive.

The Oral and Practical Exam

The FAA Oral and Practical Exam for an Aircraft Mechanic Certificate is probably one of the most difficult FAA exams to prepare for because of the large amount of material that must be learned. For this reason, test preparation plays an important role in your ability to successfully pass the exams. However, in no way do we encourage you to memorize our test preparation materials. Instead, use your test guide as an aid to gain an in-depth understanding of concepts and procedures. Ultimately, you will find that the knowledge gained will benefit you throughout your career as an Aviation Maintenance Technician.

The purpose of this section of the appendix is to help answer some of the questions you may have about the oral and practical exams. With an understanding of the testing procedures, you will likely have less apprehension during the exam, allowing you to focus on the tasks that the examiner assigns you.

Who Conducts the Oral and Practical Exams?

The Oral and Practical Exam may be given either by a Designated Mechanic Examiner (DME) or an FAA inspector. In most areas of the country, the FAA does not have the manpower to conduct the exam, in which case you will need to schedule your exams with a DME.

How Do I Locate a DME?

If you are a graduate of an AMTS, it is likely that the oral and practical exams will be conducted by a DME that is on staff with the school. If you're applying for a Mechanic's Certificate by showing occupational or military experience, you will need to locate a DME on your own to make arrangements for testing. The names and phone numbers of DMEs in your area are available by calling your local FAA Flight Standards District Office (FSDO). The phone numbers for these offices are generally found in your local phone directory under United States Government, Federal Aviation Administration, or Department of Transportation.

How Much Do the Exams Cost?

If you take your exam from a DME, they will have their own fee for each section of the exam that you take. The fees are set by the DME and vary between examiners. It is advisable for you to shop around and talk to different DMEs about their fees. Also, ask what method of payment is required. Some DMEs will only accept cash, while others will accept checks or even credit cards.

How Long Do the Exams Take?

There is no established maximum time limit for the exams. However, there is a minimum time requirement. The minimum time allocated for the General Oral and Practical Exams is 2 hours, while the Airframe or Powerplant Exams require 4 hours each to complete. If you do not already hold a Mechanic Certificate, you will be required to take both the General and Airframe or Powerplant Exams for a total minimum time of 6 hours. However, if you already hold an Aircraft Mechanic Certificate with one rating, you will not be required to retake the General Mechanic Exam to obtain the other rating. Although these minimum times have been established, the actual times vary. It is not uncommon for the exams to take two or three times longer than the minimum requirements. Ask the examiner about typical time requirements when making arrangements to take the exams, and plan your schedule to allow adequate time to complete them.

What Items Should I Bring For the Exams?

Since you and the examiner must schedule a large block of time for the exams, it is critical that you come with all the required materials. The following items should be organized and readily available to you no later than one day before your scheduled exam. If you fail to bring any of the following items with you for the exam, the examiner may not begin administering any portion of the exam, and you will have to reschedule another time with the examiner. To verify that you have the required items, use the following list to check off items before departing to take the exam. The required items include:

_____ Two copies of FAA Form 8610-2 with original signatures — if you obtained these documents from an FAA Airworthiness Inspector, the inspector's original signature must be included.

- _____ Original Airman Knowledge Exam results — copies are not accepted and if the originals are lost, you must request a replacement from the FAA. The address and information that must be included with the request are given in the introduction section of this test guide. Keep in mind that the replacements may take over a week to obtain.
- _____ Photo Identification — acceptable photo identifications include a state issued driver's license or photo identification, government identification card, passport, alien residency (green) card, or military identification card.
- _____ Examiner's Fee — correct cash or other form of payment as arranged with the examiner.
- _____ Basic Hand Tools — assorted ratchets and sockets, screwdrivers, wrenches, mirror, flashlight, and other hand tools as required by the examiner.
- _____ Reference Materials — consider bringing the General, Powerplant, and/or Airframe Textbooks, AC 43.13-1B and 2A, and other reference materials that you may find useful. You can use the reference materials while taking the practical portion of the test but cannot use any references during the oral portion of the exam, except those given to you by the examiner.
- _____ Calculator, pencil, black ink pen, and paper.

What Areas Will I Be Tested On?

The Oral and Practical Exam is designed so that the examiner can evaluate your performance to determine that you will be a competent and safe aircraft mechanic and that you at least meet the minimum requirements for certification. To verify that you are knowledgeable in all areas required by FAR Part 65, you will be tested in each subject area for the Airframe Mechanic Certificate. These subjects include the following:

1. Aircraft Assembly and Rigging
2. Sheet Metal Structures
3. Wood Structures
4. Aircraft Welding
5. Aircraft Covering
6. Aircraft Finishes
7. Aircraft Electrical Systems
8. Hydraulic and Pneumatic Power Systems
9. Aircraft Landing Gear Systems
10. Position and Warning Systems
11. Aircraft Instrument Systems
12. Communication and Navigation Systems
13. Ice and Rain Control Systems
14. Cabin Atmosphere Control Systems
15. Aircraft Fuel Systems
16. Fire Protection Systems
17. Airframe Inspection ,

How is the Oral Exam Conducted?

The oral exam may be conducted in different ways depending on the examiner. Some examiners conduct the oral exam first before having you do any of the practical portions of the test, while others may ask you oral questions while you perform the practical portion of the exam. In either case, the examiner will ask you a minimum of four questions that relate to each subject area. Of these four questions, you must correctly answer 3 out of 4 to pass. If you miss more than one question, at the discretion of the examiner, additional questions may be asked to further evaluate your knowledge of the subject area. If additional questions are asked, you must correctly answer 70% of all the questions to pass the subject area.

If you do not already hold an Aircraft or Powerplant Mechanic Certificate, you will also be required to take the General Mechanic oral exam. These may be administered before the General exams, or in some cases, the examiner may elect to vary the order. Regardless of the order that the exams are taken, you must pass all the oral questions in both the General and Airframe or Powerplant subject areas. This means that you will be required to answer a minimum of 48 General questions (12 subject areas) and 68 Airframe or Powerplant questions (17 subject areas).

When taking the oral exam, it is best to listen carefully to the question and formulate your answer before responding. Try to keep your answers as direct to the question as possible. This will save time and keep the examiner from feeling the need to delve further into the subject area if your explanation is confusing.

If you do not understand the question, you can ask the examiner to elaborate further. In some cases, the examiner can rephrase the question, but in others the examiner will only repeat the question if they feel you should understand what is being asked. Regardless of the examiner's response, there is no harm in asking for clarification. Also, keep in mind that in no case is the examiner allowed to teach during the exam. If they feel that further elaboration may cause them to give you more information than they should divulge, they may elect to keep the questions very specific. In most cases, the examiner will try to remain personable, but they will keep focused on the task of administering the exam.

The examiner will also use a worksheet to keep track of your results and will likely take additional notes throughout the exam. It is required for the examiner to keep these records, so don't be concerned to see them writing after each question.

How is the Practical Exam Conducted?

The examiner will assign you projects from each of the subject areas required for the rating(s) you apply for. Depending on the examiner, you may be assigned a separate project for each subject, or you may be given a project that entails an evaluation of many subjects. For example, you may be given a project to install an up-limit switch on a landing gear. This project could allow the examiner to evaluate multiple subject areas including electrical systems, landing gear, position and warning systems, maintenance publications, and others. Regardless of the actual number of assignments that you are given, you must perform at least one practical project for each subject area. In addition, you will be required to complete an FAA Form 337 (Major Alteration and Repair Form), and to calculate a sample weight-and-balance change problem.

As mentioned earlier, the examiner will have technical manuals and special tools that you will need to complete the assigned projects. However, the examiner may not make these readily available to you. Part of the exam process includes evaluating whether you know what tools, materials and technical information you will need to work on an actual aircraft. Do not hesitate to ask the examiner where you can locate these items.

What Am I Required to Do if I Fail Part of the Exam?

The examiner will normally advise you of your progress throughout the test and give you the option to discontinue the test at any time. However, you should try to complete the exam to identify all the areas that you may be deficient in. If you complete the exam and only have a few failed subject areas, you will only be tested on the failed subjects if you retest with the same examiner. However, if you go to another examiner, you will be required to repeat the entire test.

In the event you fail any subject area, Part 65 requires that you wait 30 days before reapplying for the exam, unless you receive additional instruction from an airman holding the rating that you are seeking. The person that provides you with the additional instruction should give you a written statement detailing the number of hours of instruction they provided along with a brief description of what subject areas were covered. In addition, the statement should contain the person's signature, certificate type, and airman certificate number.

When Do I Receive my Airman's Certificate?

If you pass all areas of the oral and practical exam, you will be issued a Temporary Airman's Certificate that is immediately effective. The examiner may issue the temporary certificate on the day of the exam, or depending on the arrangements between the local FSDO and the examiner, it may be issued later by mail

by the FSDO. In either case, the temporary certificate is effective for 120 days from the date of issuance. If you do not receive a permanent Airman's Certificate in the mail before your temporary certificate expires, you should contact your local FSDO to track your records and make an arrangement to issue you another temporary certificate. An FSDO inspector is the only person authorized to reissue a temporary certificate.

Suggestions for Military Applicants

Applicants coming from the military typically show a lack of experience with the civil aircraft manufacturer's technical manuals and Federal Aviation Administration documents. If you are applying for certification based on military experience, it is strongly recommended that you receive supplementary instruction in the use of civil aircraft manufacturer's illustrated parts catalogs, service manuals, and service information literature. You should also review federal publications such as Type Certificate Data Sheets, Airworthiness Directives, Advisory Circulars, and Supplemental Type Certificate Data Sheets before applying for the test.

In most cases, additional practical instruction in these areas can be received at a local AMTS or a Fixed Base Operation maintenance shop where you can contract with someone to instruct you. In some cases, you might even work with the DME that will be giving you your exam. This is not objectionable since the DME will likely not teach you the exam, but instead will teach you the material needed to be a safe and competent mechanic. Once the exam commences, the examiner will not provide any instruction, and they will evaluate you solely on your ability to do the work on your own.

Aside from these areas of study, most military applicants have adequate exposure to the tools, equipment, and maintenance practices to complete the FAA exams with the same amount of preparation as applicants coming from an AMTS. Regardless of whether you are coming from a military or civil background, the best way to guarantee success is with preparation. Our Airframe Test Guide assures that you have the most thorough and complete test preparation materials available.

NOTES

Chapter 1 — Aircraft Structural Assembly and Rigging

Q #	Question and Answer	Page Reference
1	What is the function of a vortex generator? <i>Answer – It is designed to delay or prevent separation of the boundary layer.</i>	JSAT 1-13
2	What are the three axes of an airplane? <i>Answer – Longitudinal, lateral, and vertical.</i>	JSAT 1-20
3	What are the three primary flight controls of an aircraft? <i>Answer – The ailerons, elevator, and rudder.</i>	JSAT 1-24
4	Name several secondary flight controls and describe their general purpose? <i>Answer – Secondary flight controls consist of various types of trim tabs such as balance tabs, anti-servo and servo tabs, and spring tabs. Their function is to assist the pilot in moving the controls and to trim the aircraft to fly hands-off.</i>	JSAT 1-28
5	Name several types of auxiliary flight controls and describe their general purpose? <i>Answer – The auxiliary flight controls consist of the various high-lift devices used during low-speed flight such as leading and trailing edge flaps, slats, slots, speed brakes, etc.</i>	JSAT 1-28
6	What is a servo trim tab? <i>Answer – It is an auxiliary control, positioned by the movement of a cockpit control and designed to create aerodynamic forces to assist in moving a control surface.</i>	JSAT 1-29
7	What is a spring tab? <i>Answer – It is an auxiliary control designed to aid the movement of a primary control at high speeds when control forces become too high.</i>	JSAT 1-29
8	What is a balance trim tab? <i>Answer – It is an auxiliary control designed to create aerodynamic forces to assist in moving a control surface. The tab is positioned by a control rod connected to the fixed surface on the same side as the horn on the tab.</i>	JSAT 1-29
9	What are four most common types of high lift devices? <i>Answer – Leading and trailing edge flaps, slats, and slots.</i>	JSAT 1-30
10	Describe some of the tools used to check control surface travel? <i>Answer – A universal propeller protractor or special control surface protractor.</i>	JSAT 1-39
11	Name three mechanical methods by which flight control systems may be actuated. <i>Answer – Cables, push-pull rods, and torque tubes.</i>	JSAT 1-41
12	What is a fairlead? <i>Answer – It is a device to prevent a cable from rubbing on the aircraft structure.</i>	JSAT 1-44
13	What are the most likely places for a control cable to wear or break? <i>Answer – Where the cables pass over pulleys or through fairleads.</i>	JSAT 1-44

Chapter 1 — Aircraft Structural Assembly and Rigging

Q #	Question and Answer	Page Reference
14	What information is required before a cable rigging chart can be used? <i>Answer – The ambient temperature and the cable size.</i>	JSAT 1-46
15	What is the function of a cable tension regulator? <i>Answer – It automatically adjusts the cable tension to compensate for expansion and contraction in the aircraft structure.</i>	JSAT 1-46
16	Describe the function of a rotorcraft collective pitch control. <i>Answer – The collective control causes each rotor blade to change its pitch angle by the same amount, thus increasing or decreasing the lift produced by the rotor.</i>	JSAT 1-62
17	Describe the function of a rotorcraft cyclic pitch control. <i>Answer – The cyclic control tilts the main rotor disc by changing the pitch angle of each rotor blade during its cycle of rotation, which causes the helicopter to move in the direction the rotor tilts.</i>	JSAT 1-64
18	What mechanism is most commonly used to compensate for the torque produced by the main rotor of a helicopter? <i>Answer – The tail (or anti-torque) rotor.</i>	JSAT 1-65
19	How is the amount of thrust produced by the tail rotor controlled? <i>Answer – By moving the foot pedals.</i>	JSAT 1-66
20	Why should control surfaces be locked when an aircraft is parked? <i>Answer – To prevent damage from the wind.</i>	JSGT 13-14

Chapter 1 — Aircraft Structural Assembly and Rigging

Project #	Project Description	Level
1	<p>Project: Locate the procedures for rigging a helicopter and tracking the rotor blades.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the procedures required to rig a helicopter and track its rotor blades.</p>	1
2	<p>Project: Locate the causes of vertical vibration in a two-bladed helicopter rotor system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the causes of vertical vibration in the two-bladed rotor system</p>	1
3	<p>Project: Identify the rigging adjustment locations on a fixed-wing aircraft.</p> <p>Given: A fixed-wing aircraft, or drawings of a fixed-wing aircraft, and reference material.</p> <p>Performance Standard: The applicant will point out the rigging adjustment locations.</p>	2
4	<p>Project: Interpret the theory of flight</p> <p>Given: Drawings of an aircraft in different flight positions.</p> <p>Performance Standard: The applicant will list the movement expected of the flight control surfaces in the drawings.</p>	2
5	<p>Project: Identify the three axes of an aircraft and the flight controls that provide movement about each axis.</p> <p>Given: A fixed-wing aircraft, or aircraft drawings, and reference material.</p> <p>Performance Standard: The applicant will list the three axes and point out the control surface(s) that provide movement about each axis.</p>	2
6	<p>Project: Locate the methods and procedures for leveling and jacking an aircraft.</p> <p>Given: Manufacturer's Maintenance Manuals and reference material.</p> <p>Performance Standard: The applicant will locate the leveling and jacking methods for an aircraft</p>	1
7	<p>Project: Verify the alignment of an empennage.</p> <p>Given: An aircraft, necessary tools, and reference material.</p> <p>Performance Standard: The applicant will use the proper tools to verify the alignment of the empennage of the aircraft.</p>	3
8	<p>Project: Verify the alignment of landing gear.</p> <p>Given: An aircraft, necessary tools, and reference material.</p> <p>Performance Standard: The applicant will use the proper tools to verify the alignment of the landing gear of the aircraft.</p>	3
9	<p>Project: Inspect a flight control system for correct travel and security.</p> <p>Given: An aircraft, necessary tools, and reference material.</p> <p>Performance Standard: The applicant will inspect the flight control system in accordance with the reference material.</p>	3

Chapter 1 — Aircraft Structural Assembly and Rigging

Project #	Project Description	Level
10	<p>Project: Remove and install a primary flight control surface.</p> <p>Given: An aircraft, necessary tools, and reference material.</p> <p>Performance Standard: The applicant will remove and reinstall a primary flight control surface using the proper torque and safety fasteners.</p>	3
11	<p>Project: Assemble one or more aircraft components.</p> <p>Given: Aircraft components such as landing gear, control surfaces, wing struts or empennage, necessary tools, and reference material.</p> <p>Performance Standard: The applicant will assemble the specified components using correct bolt torque and safety fasteners.</p>	3
12	<p>Project: Inspect primary flight control cables.</p> <p>Given: An aircraft and reference material.</p> <p>Performance Standard: The applicant will inspect a primary flight control cable system, or a portion thereof, in accordance with the reference material.</p>	3
13	<p>Project: Install swaged cable terminals.</p> <p>Given: Samples of 7 X 19 cable, appropriate terminals, tools, and reference material.</p> <p>Performance Standard: The applicant will swage cable terminals and list the tensile strength of the selected sample</p>	3
14	<p>Project: Remove and install a primary flight control cable.</p> <p>Given: An aircraft, necessary tools, and reference material.</p> <p>Performance Standard: The applicant will remove a control cable and reinstall it with the proper cable tension as listed in the reference material.</p>	3
15	<p>Project: Adjust a push-pull flight control system.</p> <p>Given: An aircraft or mockup with a push-pull flight control system, tools, and reference material.</p> <p>Performance Standard: The applicant will check the system and adjust it as necessary to obtain the correct control surface travel.</p>	3
16	<p>Project: Verify the static balance of a primary flight control surface.</p> <p>Given: A primary flight control surface, balancing equipment, and reference material.</p> <p>Performance Standard: The applicant will verify the static balance condition of the control surface and determine if it is within specifications.</p>	3
17	<p>Project: Identify the leveling and jacking points on an aircraft.</p> <p>Given: An aircraft and reference material.</p> <p>Performance Standard: The applicant will point out the leveling and jacking points on the aircraft.</p>	2
18	<p>Project: Troubleshoot an externally braced wing problem</p> <p>Given: Actual or simulated pilot trouble reports, aircraft or aircraft drawings, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot complaints and list possible causes and adjustments needed to correct an out-of-rig condition.</p>	3

Chapter 1 — Aircraft Structural Assembly and Rigging

Project #	Project Description	Level
19	<p>Project: Check the angle of incidence of a wing to verify proper wash-in or wash-out rigging.</p> <p>Given: Aircraft with adjustable incidence rigging, rigging tools, and reference material.</p> <p>Performance Standard: The applicant will measure the incidence angle of a wing and check the readings to specifications.</p>	3
20	<p>Project: Identify the flight control components of a helicopter and describe the movement of the aircraft with the application of various control movements.</p> <p>Given: A helicopter or helicopter drawings.</p> <p>Performance Standard: The applicant will describe the primary flight control components of a helicopter and describe the movement with the application of various flight controls using proper terminology.</p>	1

NOTES

Chapter 2 — Sheet Metal Structures

Q #	Question and Answer	Page Reference
1	What is the major type of damage to aluminum structures that is caused by exposure to the weather? <i>Answer – Corrosion</i>	JSAT 2-13
2	Name several methods for forming sheet metal? <i>Answer – Bending or folding, stretching, shrinking, bumping, and crimping.</i>	JSAT 2-29
3	What are the dimensions of a properly formed rivet head? <i>Answer – The head should be 1 1/2 times the shank diameter in width and 1/2 the shank diameter in height.</i>	JSAT 2-36
4	Describe the markings found on the heads of A, B, D, AD, and DD rivets. <i>Answer – A rivets are plain, B rivets have a cross, D rivets have a raised dot, AD rivets have a dimple, and DD rivets have a double dash.</i>	JSAT 2-39
5	What happens to the stem of a self-plugging (friction lock) rivet when the rivet is installed? <i>Answer – The stem is pulled until it snaps off and the remaining projecting part is trimmed flush with the head.</i>	JSAT 2-40
6	Name at least three types of self-plugging mechanical lock rivets. <i>Answer – CherryMax, CherryLock, Olympic-Locs, and Huck.</i>	JSAT 2-40
7	What is the difference between the tools required to pull a CherryLock rivet and a CherryMax rivet? <i>Answer – CherryLock rivets require a tool for each different size and head shape, while one pulling tool will set any size Cherry Max rivet.</i>	JSAT 2-41
8	Which of the five stresses is the most common cause of rivet failure? <i>Answer – Shear</i>	JSAT 2-51
9	If a 2024 rivet must be replaced with a 2117 rivet, how do you determine the size to be used? <i>Answer – For 5/32" or smaller diameter, use the next larger size 2117 rivet, assuming that the edge distance and spacing meet the minimum requirements.</i>	JSAT 2-51
10	Describe the process for determining the total length of a solid rivet for a particular installation. <i>Answer – Add the grip length (thickness of the materials being joined) plus 1 1/2 times the rivet diameter.</i>	JSAT 2-51
11	What minimum edge distance and spacing should be used for a single row of protruding head rivets? <i>Answer – Not less than two rivet diameters from the edge and not less than three rivet diameters apart.</i>	JSAT 2-54
12	How can a mechanic determine whether the countersink for a flush rivet should be dimpled or drilled? <i>Answer – By the thickness of the top sheet; thin sheets are dimpled while thick sheets may be countersunk.</i>	JSAT 2-59

Chapter 2 — Sheet Metal Structures

Q #	Question and Answer	Page Reference
13	<p>What action is taken to prevent cracks from forming while dimpling magnesium or some hard sheet metals?</p> <p><i>Answer – Hot dimpling equipment is used to preheat and soften the metal before the dimple is formed.</i></p>	JSAT 2-60
14	<p>What type of damage can occur when using a rivet set that does not properly fit the rivet?</p> <p><i>Answer – If the radius of the set is too small, the rivet head may be damaged, whereas a set with an over-sized radius may cause damage to the sheet metal.</i></p>	JSAT 2-64
15	<p>Why is it important to use the proper size and weight bucking bar when performing sheet metal riveting?</p> <p><i>Answer – If a bucking bar is too large or heavy it may be difficult to control and may cause damage to the surrounding structure, whereas a bucking bar that is too light will not properly upset the rivet before work hardening occurs.</i></p>	JSAT 2-64
16	<p>What procedures should be followed to properly remove a solid-shank rivet?</p> <p><i>Answer – Center punch the rivet and then drill just to the base of the rivet head with the same size or one size smaller drill. Once drilled, use a pin punch to tip off the rivet head and drive the remaining shank out of the hole while supporting the surrounding metal.</i></p>	JSAT 2-67
17	<p>What are the two special calculations that must be made when bending sheet metal?</p> <p><i>Answer – Bend allowance and setback.</i></p>	JSAT 2-71
18	<p>What factors must be considered in order to determine setback?</p> <p><i>Answer – The thickness of the metal and the bend radius.</i></p>	JSAT 2-71
19	<p>What is done to a corner where two bends intersect to prevent cracking?</p> <p><i>Answer – Relief holes are drilled in the corner.</i></p>	JSAT 2-77
20	<p>What are the two reasons for installing a lightening hole in a sheet metal wing rib?</p> <p><i>Answer – Lightening holes reduce the weight and increase stiffness.</i></p>	JSAT 2-81
21	<p>Describe a joggle and explain its function.</p> <p><i>Answer – A joggle is an offset formed at an intersection of two or more sheets of metal to allow the multiple sheets to be stacked flat against each other.</i></p>	JSAT 2-82
22	<p>When repairing an all-metal aircraft, how do you determine what metals should be used?</p> <p><i>Answer – Always use metal of the same type and thickness as the original structure.</i></p>	JSAT 2-86

Chapter 2 — Sheet Metal Structures

Project #	Project Description	Level
1	<p>Project: Install one or more types of special fastener.</p> <p>Given: Dzus, Cam-loc, Air-loc, or other similar fasteners, sheet metal tools, and reference material.</p> <p>Performance Standard: The applicant will drill the necessary holes in the sheet metal and install the specified fasteners using the reference materials as a guide.</p>	3
2	<p>Project: Install a Rivnut or Dill nut.</p> <p>Given: Rivnuts or Dill nuts, sheet metal, appropriate tools, and reference material.</p> <p>Performance Standard: The applicant will drill the necessary holes in the sheet metal and install Rivnuts or Dill nuts using the reference materials as a guide.</p>	3
3	<p>Project: Install pull-type mechanical lock rivets.</p> <p>Given: Pull-type rivets, drilled sheet metal sheets, appropriate tools, and reference materials.</p> <p>Performance Standard: The applicant will fasten the sheets with pull-type rivets.</p>	3
4	<p>Project: Determine the minimum number of rivets required to repair damage to a main structural member.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will determine the number of rivets required to perform the repair.</p>	2
5	<p>Project: Countersink holes to a tolerance of 0.010 inches.</p> <p>Given: Aluminum sheet metal, tools, and reference material.</p> <p>Performance Standard: The applicant will countersink the holes in accordance with the reference material.</p>	3
6	<p>Project: Inspect a pilot seat and seatbelt.</p> <p>Given: An aircraft and reference material.</p> <p>Performance Standard: The applicant will inspect the pilot seat for security to the aircraft structure and the seatbelt for FAA-PMA approval</p>	3
7	<p>Project: Identify different types of rivets.</p> <p>Given: Rivet samples and reference material.</p> <p>Performance Standard: The applicant will identify the sample rivets.</p>	2
8	<p>Project: Install and remove rivets.</p> <p>Given: Samples of aluminum sheet, aircraft structure or a structural mockup, rivets, tools, and reference material.</p> <p>Performance Standard: The applicant will rivet sheets of aluminum or examples of a typical structure together using different rivet sizes with different heads, and then remove the rivets using correct procedures.</p>	3

Chapter 2 — Sheet Metal Structures

Project #	Project Description	Level
9	<p>Project: Layout several riveted repairs, determine rivet hole size, and select the correct rivet sizes.</p> <p>Given: Drawings of typical repairs involving different combinations of aluminum sheet of varying thickness, a list of rivet sizes, and reference material.</p> <p>Performance Standard: The applicant will lay out the assigned repairs, determine the proper grip length and rivet length as required, and list the hole size for the various rivet diameters.</p>	2
10	<p>Project: Make 90 degree bends in sheet aluminum.</p> <p>Given: Aluminum sheet samples of different thicknesses, a cornice brake, and reference material.</p> <p>Performance Standard: The applicant will lay out each sample using the proper bend allowance and direction of grain, then bend the sample.</p>	3
11	<p>Project: Form soft aluminum sheet.</p> <p>Given: A sample part, soft aluminum sheet, form blocks, tools, and reference material.</p> <p>Performance Standard: The applicant will bump the soft aluminum using hand tools to duplicate the sample part.</p>	3
12	<p>Project: Fabricate aluminum parts.</p> <p>Given: A “U” channel with two 90 degree bends, sheet aluminum, bending and layout tools, and reference material.</p> <p>Performance Standard: The applicant will measure the sample part, calculate the bend allowance, and duplicate the part.</p>	3
13	<p>Project: Repair a hole in an aluminum sheet.</p> <p>Given: A mockup with hole damage, repair materials and equipment, and reference material.</p> <p>Performance Standard: The applicant will fabricate and install a flush patch in the damaged area.</p>	3

Chapter 3 — Wood, Composite, and Transparent Plastic Structures

Q #	Question and Answer	Page Reference
1	What are the three forms of wood commonly used in aircraft construction? <i>Answer – Solid, laminated, and plywood.</i>	JSAT 3-2
2	What type of wood should be used when splicing or reinforcing plywood webs? <i>Answer – The same type of plywood as originally used.</i>	JSAT 3-3, 3-17
3	Name at least four different types of defects found in wood. <i>Answer – Knots, checks, splits, pitch pockets, cross grain, curly grain, decay, dry rot, etc.</i>	JSAT 3-4
4	Can a section of wood containing a hard knot be used? <i>Answer – Yes, within specified limits.</i>	JSAT 3-5
5	What type of glue may have been used in older wooden aircraft construction that requires careful inspection to detect deterioration? <i>Answer – Casein glue.</i>	JSAT 3-6
6	What are the three types of glues used in modern aircraft construction and repair? <i>Answer – Resorcinol glue, Phenol-formaldehyde glue, and epoxy resin glue.</i>	JSAT 3-6
7	Is compression wood acceptable for structural repairs? <i>Answer – No.</i>	JSAT 3-6
8	Why should the various pieces of wood being joined be kept in the same room for at least 24 hours prior to joining? <i>Answer – To allow the moisture content to equalize, thereby minimizing dimensional changes in the wood.</i>	JSAT 3-7
9	Why is it important to consider the open-assembly time when gluing wooden structures? <i>Answer – If the maximum open-assembly time is exceeded, the joint may fail since the glue may begin setting up before the joint is assembled.</i>	JSAT 3-7
10	Why is it important to apply the proper clamping pressure to a glue joint? <i>Answer – Clamping forces air out of the joint, brings the wood surfaces together evenly and is, in part, responsible for the strength of the glue line.</i>	JSAT 3-8
11	Describe some of the methods used to apply pressure to glue joints. <i>Answer – Clamps, nailing strips, power presses, brads, nails, and small screws.</i>	JSAT 3-8
12	What minimum curing temperature should be observed when joining wood with various adhesives? <i>Answer – 70 degrees Fahrenheit or as specified by the glue manufacturer.</i>	JSAT 3-8
13	When inspecting wood structures, why might it be important to consider stains and discolored areas? <i>Answer – Stains and discoloration usually accompany decay and/or rot.</i>	JSAT 3-10

Chapter 3 — Wood, Composite, and Transparent Plastic Structures

Q #	Question and Answer	Page Reference
14	Describe the acceptable methods used to repair elongated bolt holes found in a wooden wing spar. <i>Answer – Remove the section containing the elongated hole(s) and splice in a new section or replace the entire spar.</i>	JSAT 3-11
15	What type of joint is used to splice a solid or rectangular wood spar? <i>Answer – A scarf joint</i>	JSAT 3-12
16	In what areas are splices to a wood spar prohibited? <i>Answer – Under an attachment fitting for the wing root, landing gear, engine-mount, lift, or inter-plane strut.</i>	JSAT 3-12
17	What is the maximum number of splices allowed for any single spar? <i>Answer – Two</i>	JSAT 3-12
18	Describe the characteristics of a scarf joint. <i>Answer – The pieces to be joined are tapered or beveled on a slope of 1 to 10 or 1 to 12.</i>	JSAT 3-12
19	Why must the beveled cut be accurate on both pieces of wood being repaired with a scarfed joint? <i>Answer – The two pieces must match exactly to ensure a tight glue joint.</i>	JSAT 3-13
20	What are the two primary uses for plywood in aircraft construction? <i>Answer – Gusset (or reinforcing) plates and aircraft skin.</i>	JSAT 3-16
21	Provide examples of at least three types of plywood skin repairs. <i>Answer – Splayed patches, surface patches, plug patches, and scarfed patches.</i>	JSAT 3-18
22	What type of patch should be used to repair small holes in thin plywood skin if the skin is less than 1/10th inch thick? <i>Answer – A splayed patch may be used if the hole can be cleared out to a diameter of less than 15 thicknesses of the skin.</i>	JSAT 3-18
23	What should be done to prevent a plywood patch and the pressure plate from sticking together if glue is extruded from the joint? <i>Answer – Place a piece of waxed paper or vinyl plastic between the patch and the pressure plate.</i>	JSAT 3-18
24	Why are lightweight steel bushings sometimes used in wooden structures? <i>Answer – Bushings prevent the wood from being crushed when bolts are tightened.</i>	AC 43.13-1B
25	What is the purpose of large surface area washers when used on wooden structures? <i>Answer – Large washers provide additional bearing area for hardware to help preclude damage to the wood when the hardware is tightened.</i>	AC 43.13-1B

Chapter 3 — Wood, Composite, and Transparent Plastic Structures

Q #	Question and Answer	Page Reference
26	Name several facings and core materials used in bonded honeycomb structures intended for special applications. <i>Answer – Stainless steel, titanium, magnesium, plywood, glass, nylon, and cotton cloth.</i>	JSAT 3-31
27	Describe the construction of a bonded honeycomb structure. <i>Answer – It is a laminated structure that has a solid facing bonded to either side of a core consisting of open, six-sided cells.</i>	JSAT 3-32
28	What must be done with a damaged area in a bonded honeycomb structure prior to beginning repairs? <i>Answer – The damaged area must be completely removed.</i>	JSAT 3-49
29	A drill bit used for drilling composites should have an included angle of how many degrees? <i>Answer – 135 degrees.</i>	JSAT 3-42
30	What are the most common causes for delamination of a composite structure? <i>Answer – Sonic vibration, expansion of internal moisture, liquid leakage, and a manufacturing error.</i>	JSAT 3-51
31	What type of defect in, or damage to, a bonded honeycomb structure can be repaired using the potted repair method? <i>Answer – Filling a hole.</i>	JSAT 3-57
32	Name some of the factors that cause crazing in transparent plastic windows and windshields? <i>Answer – Exposure to ultraviolet light, stress, solvents, and improper handling.</i>	JSAT 3-63, 3-68
33	How should a hole be drilled in Plexiglas® to avoid damage to the hole when the drill breaks through to the underside? <i>Answer – Back up the plastic with a piece of wood and feed the drill slowly.</i>	JSAT 3-65

Chapter 3 — Wood, Composite, and Transparent Plastic Structures

Project #	Project Description	Level
1	<p>Project: Research reference material, list three types of wood used in aircraft structures, and locate a wood substitute chart. Determine if western hemlock can be substituted for spruce, and list what, if any, dimensional changes are necessary.</p> <p>Given: Appropriate reference materials.</p> <p>Performance Standard: The applicant will list three types of wood used for aircraft structures, locate the required wood substitute chart, decide if the substitution is allowed, and list any dimensional changes that may be necessary.</p>	1
2	<p>Project: Research reference material and determine the standard dimensions for oval and round plug patches and the general requirements for scarf splice joints.</p> <p>Given: Appropriate reference materials.</p> <p>Performance Standard: The applicant will locate the required dimensions and the requirements for plug patches and scarf joints.</p>	1
3	<p>Project: Research reference material to locate procedures for selecting glue used for wood structural repairs and identify a protective finish for a wood structure.</p> <p>Given: Reference materials, a list of protective finishes, and a drawing of a wooden structure needing a protective finish.</p> <p>Performance Standard: The applicant will locate the correct procedures for selecting glue and select the appropriate protective finish for the wood structure.</p>	1
4	<p>Project: Research reference material and determine the proper procedures for repairing elongated bolt holes in a wood structure.</p> <p>Given: Appropriate reference materials.</p> <p>Performance Standard: The applicant will locate the proper repair procedure and provide a page reference.</p>	1
5	<p>Project: Identify various defects in wood samples, determine which samples contain defects that are not allowed, and select the samples that may be suitable for a structural repair.</p> <p>Given: Samples of wood with and without defects and reference material.</p> <p>Performance Standard: The applicant will select those samples that are acceptable for use in making aircraft structural repairs and describe the nature of the defects in the rejected samples.</p>	2
6	<p>Project: Inspect a solid wood structure.</p> <p>Given: Reference material and a sample of a solid wood structure.</p> <p>Performance Standard: The applicant will inspect the structure and correctly determine if it contains defects that are not permitted.</p>	3
7	<p>Project: Inspect a plywood structure.</p> <p>Given: Reference material and a sample of a plywood structure.</p> <p>Performance Standard: The applicant will inspect the structure and correctly determine if it contains defects that are not permitted.</p>	3

Chapter 3 — Wood, Composite, and Transparent Plastic Structures

Project #	Project Description	Level
8	<p>Project: Inspect a repair to a wood structure.</p> <p>Given: A sample of a typical wood repair such as a splice joint, surface or plug patch and reference material.</p> <p>Performance Standard: The applicant will inspect the repair and determine if the repair conforms with the reference material.</p>	3
9	<p>Project: Lay out a plywood-reinforcing gusset, including the correct nail pattern.</p> <p>Given: Reference material and a drawing of a wooden rib structure.</p> <p>Performance Standard: The applicant will draw a repair layout that conforms to the requirements of AC 43.13-1B.</p>	2
10	<p>Project: Lay out a repair to a damaged plywood skin in an area without underlying structure.</p> <p>Given: Reference material and the dimensions of the damaged area.</p> <p>Performance Standard: The applicant will draw a repair layout that conforms to the requirements of AC 43.13-1B.</p>	2
11	<p>Project: Inspect a bonded structure.</p> <p>Given: Access to a bonded structure and reference material.</p> <p>Performance Standard: The applicant will inspect the structure and list any defects found.</p>	3
12	<p>Project: Perform an inspection of a laminated structure.</p> <p>Given: Access to a laminated structure, or samples of laminated structures, and reference material.</p> <p>Performance Standard: The applicant will inspect the structure or samples for delaminations.</p>	3
13	<p>Project: Inspect an acrylic windshield.</p> <p>Given: A plastic windshield and reference material.</p> <p>Performance Standard: The applicant will inspect the acrylic windshield and list any defects such as cracking, crazing, and scratches.</p>	3
14	<p>Project: Identify various types of window enclosure material.</p> <p>Given: Samples of transparent plastic, laminated plastic, plate glass, and reference material.</p> <p>Performance Standard: The applicant will identify each sample and list its characteristics.</p>	2
15	<p>Project: Identify various laminated composite materials and identify the proper tools use for drilling and/or cutting the samples.</p> <p>Given: Samples of composite materials, a list or samples of various drilling and/or cutting tools, and reference material.</p> <p>Performance Standard: The applicant will identify the types of reinforcing materials used in the laminated samples and identify the most appropriate tools for cutting and/or drilling each sample.</p>	2

Chapter 3 — Wood, Composite, and Transparent Plastic Structures

Project #	Project Description	Level
16	<p>Project: Cut, drill, or grind composite material(s).</p> <p>Given: Composite material(s), tools and equipment, and reference material.</p> <p>Performance Standard: The applicant will use proper techniques, tools, and safety precautions to cut, drill, or grind composite material(s).</p>	3
17	<p>Project: Perform a lay up repair to a bonded composite structure.</p> <p>Given: Composite material(s), tools and equipment, and reference material.</p> <p>Performance Standard: The applicant will use proper techniques, tools, and safety precautions to lay up a bonded composite structure.</p>	2

Chapter 4 — Aircraft Welding

Q #	Question and Answer	Page Reference
1	Name the three principle types of welding. <i>Answer – Gas welding, electric arc welding, and electric resistance welding.</i>	JSAT 4-3
2	What are some advantages of gas shielded arc welding? <i>Answer – The weld is stronger, more ductile, and more corrosion resistant.</i>	JSAT 4-4
3	Which method of welding is less likely to cause buckling or warping of thin metal sheets? <i>Answer – Electric arc (or TIG) welding.</i>	JSAT 4-4
4	What is the purpose of shielding an arc weld with an inert gas? <i>Answer – The gas prevents atmospheric oxygen and/or nitrogen from contaminating the weld.</i>	JSAT 4-4
5	What is a common method of controlling expansion when welding a joint? <i>Answer – Place tack welds along the length of the joint.</i>	JSAT 4-8
6	What is the effect of inadequate penetration on a weld? <i>Answer – The weld will be weak.</i>	JSAT 4-9
7	What is the purpose of the flux used with brazing and silver soldering? <i>Answer – The flux cleans the base metal by removing any oxide film.</i>	JSAT 4-11
8	What type of flame is used when torch brazing or silver soldering? <i>Answer – A neutral flame.</i>	JSAT 4-11
9	What must be done to a soldering iron tip to increase the amount of heat transferred from the tip to the work? <i>Answer – The tip must be clean of all contaminates and properly tinned.</i>	JSAT 4-13
10	What is the preferred method for welding aluminum? <i>Answer – Tungsten Inert Gas (TIG) welding</i>	JSAT 4-16
11	What is the preferred method of welding magnesium? <i>Answer – Tungsten Inert Gas (TIG) welding</i>	JSAT 4-16
12	What precautions must be observed in order to weld titanium? <i>Answer – All traces of oxygen and nitrogen must be kept away from the weld area.</i>	JSAT 4-16
13	Describe one type of repair that could be made to a dented steel tube cluster joint. <i>Answer – A formed steel patch plate could be welded over the damaged area.</i>	JSAT 4-17
14	How can a soft flame be obtained without reducing the heat output of the torch? <i>Answer – Use a larger tip and adjust the gas pressure accordingly.</i>	JSAT 4-26
15	What factors determine the amount of heat delivered by a gas welding torch? <i>Answer – The size of the torch tip and the gas pressure.</i>	JSAT 4-26

Chapter 4 — Aircraft Welding

Q #	Question and Answer	Page Reference
16	When an oxyacetylene torch is extinguished, which valve is turned off first? <i>Answer – Turn of the acetylene gas valve first.</i>	JSAT 4-30
17	When a gas welding project is completed, what safety precautions should be accomplished? <i>Answer – All the valves are turned off and the gas pressures are relieved.</i>	JSAT 4-30
18	What should be done to a heat-treated aluminum part after welded repairs are completed? <i>Answer – The part must be re-heat treated.</i>	JSAT 7-7
19.	Welding magnesium can create a serious safety hazard. What is the nature of this hazard? <i>Answer – Magnesium burns with a very hot flame that is very hard to extinguish.</i>	JSGT 7-10
20.	What technique might be used to enable a tight-fitting inner sleeve to be inserted into a tubular repair? <i>Answer – The inner tube could be chilled with dry ice or in a freezer while the outer tube could be heated slightly with a torch.</i>	AC 43.13-1B

Chapter 4 — Aircraft Welding

Project #	Project Description	Level
1	<p>Project: Solder aircraft electrical wire and connectors.</p> <p>Given: Soldering equipment and supplies, aircraft wire and connectors, and reference material.</p> <p>Performance Standard: The applicant will join the wire and connectors together by soldering.</p>	3
2	<p>Project: Select gas welding torch tips and welding rod.</p> <p>Given: Samples of metal to be welded, a selection of torch tips and welding rods, and reference material.</p> <p>Performance Standard: The applicant will select the correct torch tip and the correct rod size and alloy for each metal sample.</p>	2
3	<p>Project: Adjust the flame of an oxyacetylene torch.</p> <p>Given: Oxyacetylene welding equipment and reference material.</p> <p>Performance Standard: The applicant will light the torch and demonstrate an oxidizing, neutral, and reducing flame.</p>	2
4	<p>Project: Create a silver solder joint.</p> <p>Given: Copper alloy flanged butt joint halves, oxyacetylene welding equipment, silver solder and flux, and reference material.</p> <p>Performance Standard: The applicant will silver solder the flanged butt joint.</p>	2
5	<p>Project: Create a brazed lap joint.</p> <p>Given: Metal samples, oxyacetylene welding equipment, brazing rods and flux, and reference material.</p> <p>Performance Standard: The applicant will braze two metal pieces together to form a lap joint.</p>	2
6	<p>Project: Locate the procedure for cleaning magnesium prior to welding.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the correct method(s) for cleaning magnesium to prepare it for welding.</p>	1
7	<p>Project: Perform oxyacetylene butt and corner welds.</p> <p>Given: Steel samples, oxyacetylene welding equipment, and reference material.</p> <p>Performance Standard: The applicant will make a butt weld joint using a rod appropriate to the metal thickness and a corner weld joint without using a welding rod.</p>	2
8	<p>Project: Perform oxyacetylene lap and tee welds.</p> <p>Given: Steel samples, oxyacetylene welding equipment, and reference material.</p> <p>Performance Standard: The applicant will perform basic oxyacetylene lap and tee welds, and identify any unacceptable areas of the completed welds. With each defect, the applicant will identify the cause, and the actions necessary to correct them.</p>	2

Chapter 4 — Aircraft Welding

Project #	Project Description	Level
9	<p>Project: Demonstrate forehand and backhand welding.</p> <p>Given: Steel samples, oxyacetylene welding equipment, and reference material.</p> <p>Performance Standard: The applicant will use a torch, make a puddle, feed in a rod, and move towards and away from the direction the weld is progressing.</p>	2
10	<p>Project: Demonstrate electric arc welding.</p> <p>Given: A metal sample, arc welding equipment, and reference material.</p> <p>Performance Standard: The applicant will use the arc welding equipment to run a bead across the metal sample.</p>	2
11	<p>Project: Select an appropriate repair procedure for a tubular structure.</p> <p>Given: Drawings of damaged aircraft tubular structures and reference material.</p> <p>Performance Standard: The applicant will select an appropriate repair procedure from the reference material for each type of damage.</p>	2
12	<p>Project: Inspect aluminum and stainless steel welds.</p> <p>Given: Samples of welded aluminum and stainless welds, some containing flaws, and reference material.</p> <p>Performance Standard: The applicant will inspect the weld samples and identify acceptable welds and those containing flaws or defects.</p>	3
13	<p>Project: Inspect welded repairs to tubular structures.</p> <p>Given: Samples of repairs to tubes, some containing flaws, and reference material.</p> <p>Performance Standard: The applicant will inspect the tubular repairs and identify acceptable welds and those containing flaws or defects.</p>	3
14	<p>Project: Inspect arc welds.</p> <p>Given: Samples of arc welds, some containing flaws, and reference material.</p> <p>Performance Standard: The applicant will inspect the arc welds and identify acceptable welds and those containing flaws or defects.</p>	3

Chapter 5 — Aircraft Fabric Covering

Q #	Question and Answer	Page Reference
1	Aircraft covering fabrics are made of materials from what two sources? <i>Answer – Organic materials and synthetic materials.</i>	JSAT 5-3
2	How would you determine the strength requirements for fabric used to re-cover an aircraft? <i>Answer – The fabric must be of at least the quality and strength of the fabric used by the original manufacturer.</i>	JSAT 5-4
3	What two types of organic fibers are used for covering aircraft? <i>Answer – Cotton and linen.</i>	JSAT 5-6
4	What is meant by warp, weft, and bias? <i>Answer – Warp is the direction along the length of the fabric, weft is the direction across the fabric at right angles to the warp, and bias is a direction at a 45 degree angle to the warp and weft.</i>	JSAT 5-6
5	What is the purpose of the selvage edge on a roll of fabric? <i>Answer – It prevents the fabric from unraveling.</i>	JSAT 5-6
6	What identification marking is found on the selvage edge, and in which direction is the warp applied? <i>Answer – The FAA-PMA stamp is found on the selvage edge and the warp is applied parallel to the line of flight.</i>	JSAT 5-6 AC 43.13-1B
7	How are the fabric type and strength requirements determined for fabric-covered aircraft? <i>Answer – The original manufacturer determines the fabric type, and the strength requirements are a function of the never-exceed speed and wing loading.</i>	JSAT 5-6
8	What types of synthetic fibers are used for covering aircraft? <i>Answer – Fiberglass and heat-shrinkable polyester fibers.</i>	JSAT 5-7
9	Which of the several types of fabric is unaffected by moisture and mildew? <i>Answer – Fiberglass</i>	JSAT 5-7
10	What is the function or purpose of reinforcing tape? <i>Answer – Reinforcing tape is used between the fabric and the rib stitching to prevent the lacing cord from cutting through the fabric.</i>	JSAT 5-8
11	Where would you use surface tape? <i>Answer – Over rib stitching and sewed seams, over lapped edges, around corners, and along leading and trailing edges.</i>	JSAT 5-8
12	How should the edges of drainage, inspection, and ventilation holes be reinforced? <i>Answer – With plastic, aluminum, or brass grommets.</i>	JSAT 5-9
13	What are the principle methods used to test the condition of fabric? <i>Answer – Punch testers such as the Maule or Seybolt tester, and laboratory pull-testing.</i>	JSAT 5-12

Chapter 5 — Aircraft Fabric Covering

Q #	Question and Answer	Page Reference
14.	Fabric is considered unairworthy when it has deteriorated to what percentage of its original strength? <i>Answer – Less than 70%.</i>	JSAT 5-12
15.	How should a structure that will be covered with doped fabric be prepared following inspection and prior to covering? <i>Answer – Treat it with a protective coating of paint or varnish as appropriate.</i>	JSAT 5-14
16.	What is the principal advantage of the envelope method for covering wings? <i>Answer – Almost all the seams are machine-sewed by the envelope supplier.</i>	JSAT 5-16
17.	What is a tie-off knot? <i>Answer – A standard, modified seine knot used on all stitches except the starting stitch.</i>	JSAT 5-16
18.	Name three common types of machine-sewed seams. <i>Answer – Plain overlap, folded-fell, and French-fell.</i>	JSAT 5-17
19.	Where are anti-tear strips used? <i>Answer – Under wing rib stitching when the never-exceed speed is greater than 250 mph.</i>	JSAT 5-19
20.	How would you determine the correct spacing for rib stitching if the original spacing was unknown? <i>Answer – Consult the chart in AC 43.13-1B.</i>	JSAT 5-19

Chapter 5 — Aircraft Fabric Covering

Project #	Project Description	Level
1	<p>Project: List the types of material used in aircraft covering and locate the general requirements for making doped and lapped seams.</p> <p>Given: Appropriate reference materials.</p> <p>Performance Standard: The applicant will list the various types of approved aircraft covering materials.</p>	1
2	<p>Project: Perform a doped-on patch repair and a sewn-on patch repair.</p> <p>Given: A damaged fabric-covered structure, appropriate materials, and reference material.</p> <p>Performance Standard: The applicant will make a minor repair by applying a doped-on patch and a sewn-on patch.</p>	3
3	<p>Project: Repair broken rib stitching.</p> <p>Given: A wing section or mockup with broken rib stitching, materials, and reference material.</p> <p>Performance Standard: The applicant will replace the broken rib stitching.</p>	3
4	<p>Project: Inspect critical areas on a fabric-covered aircraft and indicate where deterioration is most likely to occur.</p> <p>Given: A damaged fabric-covered airplane or mockup and reference material.</p> <p>Performance Standard: The applicant will point out areas such as top surfaces, dark colors, and contrasting colors where deterioration is most likely</p>	2
5	<p>Project: Test fabric materials.</p> <p>Given: Samples of fabric, testing equipment, and reference material.</p> <p>Performance Standard: The applicant will test the samples and determine if they meet minimum strength requirements.</p>	3
6	<p>Project: Perform a punch test on doped fabric.</p> <p>Given: A representative structure covered with doped fabric, a punch tester, and reference materials.</p> <p>Performance Standard: The applicant will perform a punch test, interpret the results, and determine if additional testing is required.</p>	3
7	<p>Project: Sew a French-fell and/or a folded-fell seam.</p> <p>Given: Fabric samples, sewing equipment, and reference material.</p> <p>Performance Standard: The applicant will sew the required seams.</p>	3
8	<p>Project: Repair a fabric tear using hand sewing.</p> <p>Given: A fabric-covered structure with an 8-inch tear, sewing equipment, and reference materials.</p> <p>Performance Standard: The applicant will demonstrate a hand-sewn repair using a baseball stitch and a tie-off knot.</p>	3

Chapter 5 — Aircraft Fabric Covering

Project #	Project Description	Level
9	<p>Project: Splice rib lacing cord and tie a modified seine knot.</p> <p>Given: Rib lacing cord and reference materials.</p> <p>Performance Standard: The applicant will splice the lacing cord using a splice knot and tie a modified seine knot.</p>	2
10	<p>Project: Repair fabric damage on the trailing edge of a wing.</p> <p>Given: A fabric-covered wing section with a tear near the trailing edge, repair materials, and reference materials.</p> <p>Performance Standard: The applicant will repair the damaged area in accordance with approved methods.</p>	3
11	<p>Project: Locate the factors that must be considered to select fiberglass material for covering an aircraft.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the factors that need to be considered when selecting fiberglass covering materials.</p>	1
12	<p>Project: Prepare a sample of fabric for testing in a laboratory.</p> <p>Given: A sample of doped fabric and reference materials.</p> <p>Performance Standard: The applicant will remove any dope from the fabric sample and list the acceptable testing methods in accordance with AC 43.13-1B.</p>	2
13	<p>Project: Repair and replace fabric on a fabric-covered surface using screws, special fasteners, or mechanical methods.</p> <p>Given: A fabric-covered surface, using mechanical fasteners and reference materials.</p> <p>Performance Standard: The applicant will repair and install fabric using mechanical fastener methods.</p>	3
14	<p>Project: Install ventilation and/or drainage grommets on a fabric surface.</p> <p>Given: A fabric-covered surface, a selection of grommets, tools, and reference materials.</p> <p>Performance Standard: The applicant will install the required grommets in accordance with approved methods.</p>	3
15	<p>Project: Determine if repairs to a fabric-covered surface are major or minor.</p> <p>Given: A sample of damage to a fabric-covered surface and reference material.</p> <p>Performance Standard: The applicant will inspect the damage and correctly classify it as a major or minor repair.</p>	2

Chapter 6 — Aircraft Painting and Finishing

Q #	Question and Answer	Page Reference
1	Why is butyrate dope safer to use than nitrate dope? <i>Answer – It is much less flammable.</i>	JSAT 5-3
2	What are the two types of dope used for fabric finishes? <i>Answer – Cellulose Nitrate and Cellulose Acetate Butyrate.</i>	JSAT 6-2
3	What is the appearance of a blushing paint finish? <i>Answer – Chalky or cloudy.</i>	JSAT 6-3
4	What finishing defect is the result of a paint room temperature that is too warm? <i>Answer – Pinholes or blisters.</i>	JSAT 6-3
5	What causes dope to blush? <i>Answer – High humidity, moisture in the spray system, or application over a damp surface.</i>	JSAT 6-3
6	What factors cause spray paint sags and runs? <i>Answer – Inadequate surface preparation or paint sprayed on too thickly.</i>	JSAT 6-4
7	What components or parts of the airframe must be protected from damage when using paint stripper? <i>Answer – Windshields and windows, plastics, composites, synthetic rubber, and fabrics.</i>	JSAT 6-5
8	What is the function of zinc-chromate or wash primers? <i>Answer – Primers serve to inhibit corrosion and provide a good bond between the metal and the topcoats.</i>	JSAT 6-7
9	Name several common types of paint used on aircraft. <i>Answer – Zinc-chromate and wash primers, synthetic enamels, acrylic lacquer, and polyurethane.</i>	JSAT 6-7
10	What is the proper thinner to use with zinc-chromate primer? <i>Answer – Toluene</i>	JSAT 6-14
11	What health and safety precautions must be observed when using the toxic solvents and thinners that are part of modern finishing systems? <i>Answer – Respirators and/or masks must be worn when spraying finishes.</i>	JSAT 6-18
12	If spray painting dust causes a surface to appear dry and rough, what are the most likely causes? <i>Answer – Too much air pressure or the spray gun is too far from the surface being painted.</i>	JSAT 6-21
13.	What causes “orange-peel”? <i>Answer – Spray pressure too high, use of a thinner that dries too fast, cold temperatures, or a damp draft over the surface.</i>	JSAT 6-25

Chapter 6 — Aircraft Painting and Finishing

Q #	Question and Answer	Page Reference
14	What regulation governs the application of the registration numbers to aircraft registered in the United States? <i>Answer – FAR Part 45</i>	<i>JSAT 6-26</i>
15.	Other than appearance, what is another reason for touching up painted surfaces? <i>Answer – Reduction or elimination of general corrosion problems.</i>	<i>JSAT 6-25</i>
16.	What references should be used to determine if a control surface must be checked and/or rebalanced after painting? <i>Answer – The manufacturer's service manual.</i>	<i>JSGT 14-12</i>
17.	What would be the effect if dope was used over paint or enamel? <i>Answer – The dope tends to dissolve these materials.</i>	<i>AC 43.13-1B pages 2-4</i>
18.	What are the three most commonly used methods of applying paint? <i>Answer – Dipping, brushing, and spraying.</i>	<i>AC65-15A</i>
19.	What is the effect on paint finishes if too much drier is added to the paint? <i>Answer – The paint film will be brittle and tend to crack and peel.</i>	<i>AC65-15A</i>
20.	What paint system(s) may be used with epoxy topcoats? <i>Answer – Any paint system in good condition.</i>	<i>AC65-15A</i>

Chapter 6 — Aircraft Painting and Finishing

Project #	Project Description	Level
1	<p>Project: Locate the requirements for aircraft registration numbers and specifications for their size and placement.</p> <p>Given: Appropriate reference materials.</p> <p>Performance Standard: The applicant will locate the requirements for registration numbers and for their size and placement.</p>	1
2	<p>Project: Determine the location of identification numbers on two different aircraft.</p> <p>Given: Three-view drawings and reference materials.</p> <p>Performance Standard: The applicant will determine the location of the numbers in accordance with Federal Aviation Regulations.</p>	2
3	<p>Project: Prepare a composite surface for painting.</p> <p>Given: A sample composite surface, cleaning materials, a list of different kinds of paints, and reference materials.</p> <p>Performance Standard: The applicant will select a type of paint, and clean and prepare the composite surface for the chosen paint type.</p>	2
4	<p>Project: Identify various types of finishing materials and thinners.</p> <p>Given: Reference material, a list of aircraft finishes, and a list of thinners.</p> <p>Performance Standard: The applicant will match each finish type with the appropriate thinner.</p>	2
5	<p>Project: Lay out and mask a surface for an aircraft registration number.</p> <p>Given: A specified N Number, a representative surface, masking tape, a masking template, a straight edge, and FAR Part 45.</p> <p>Performance Standard: The applicant will lay out the specified registration number on the given surface in accordance with the requirements of FAR Part 45.</p>	2
6	<p>Project: Apply dope to a fabric-covered structure with a brush and with a spray gun.</p> <p>Given: A fabric-covered structure, dope supplies, painting equipment, and reference material.</p> <p>Performance Standard: The applicant will apply dope with a dope brush and a spray gun to the fabric-covered structure.</p>	2
7	<p>Project: Prepare a metal surface for painting and paint the surface with a spray gun.</p> <p>Given: A metal-covered structure or mockup, cleaning materials, a list of various kinds of paint, and reference materials.</p> <p>Performance Standard: The applicant will select a kind of paint, and clean and prepare the surface for the selected paint.</p>	2
8	<p>Project: Adjust a spray gun and paint a metal-covered structure.</p> <p>Given: A spray gun, primer and paint, and reference materials.</p> <p>Performance Standard: The applicant will adjust the paint spray gun for the primer and paint used then prime and paint a metal-covered structure.</p>	2

Chapter 6 — Aircraft Painting and Finishing

Project #	Project Description	Level
9	<p>Project: Inspect a doped fabric finish.</p> <p>Given: A structure covered with doped fabric and reference material.</p> <p>Performance Standard: The applicant will inspect the structure covered with doped fabric and identify various defects such as bubbles, pinholes, blushing, orange peel, etc.</p>	3
10	<p>Project: Prepare a paint spraying air system for use.</p> <p>Given: A complete paint spraying air system and reference material.</p> <p>Performance Standard: The applicant will inspect the system and prepare it for use.</p>	2
11	<p>Project: Inspect an acrylic nitrocellulose lacquer finish.</p> <p>Given: An aircraft structure or mockup with an acrylic lacquer finish and reference materials.</p> <p>Performance Standard: The applicant will inspect the paint topcoat finish and identify various defects such as orange peel, runs, sags, blushing, peeling, and pebble effect.</p>	3
12	<p>Project: Identify various paint finish defects.</p> <p>Given: Samples of paint finish defects, a list of defects, and reference materials.</p> <p>Performance Standard: The applicant will match the sample defects with the name of the defect.</p>	2
13	<p>Project: Identify the type of paint used on a given aircraft.</p> <p>Given: Aircraft records, maintenance manual, and reference materials.</p> <p>Performance Standard: The applicant will locate the original or repainting information in the aircraft records or maintenance manual.</p>	2
14	<p>Project: Inspect an aluminum surface, apply an etching solution and a conversion coating (Alodine).</p> <p>Given: An aluminum surface, etching and conversion coating materials, and reference material.</p> <p>Performance Standard: The applicant will inspect the surface and correctly apply the coatings.</p>	3
15	<p>Project: Determine if the control surfaces of a given aircraft have been repainted. If so, is rebalancing required and has it been accomplished?</p> <p>Given: An aircraft, aircraft records, and reference material.</p> <p>Performance Standard: The applicant will review the aircraft records, determine if the control surfaces have been repainted, locate the requirements for rebalancing and determine if it has been accomplished.</p>	2

Chapter 7 — Airframe Electrical Systems

Q #	Question and Answer	Page Reference
1	What could cause an AC electric motor to run too fast? <i>Answer – Excessive applied voltage or shorted field windings.</i>	JSAT 7-12
2	What tool is used to check a motor or generator armature for shorts and opens under load conditions? <i>Answer – A Growler.</i>	JSAT 7-16
3	When using a Growler, what indication will occur when a short exists between an armature segment? <i>Answer – When a metal blade is held over the armature and a short exists in a segment, the blade will begin to vibrate and “chatter.”</i>	JSAT 7-16
4	How is the output voltage of an alternator controlled? <i>Answer – By varying the field current that excites the alternator.</i>	JSAT 7-21
5	What instruments are used to monitor electrical system loads? <i>Answer – Ammeters and voltmeters.</i>	JSAT 7-49
6	How would you identify a specific wire in a wire bundle? <i>Answer – By the identification code marked on the wire.</i>	JSAT 7-54
7	What tool would you use to determine the size of an unmarked wire? <i>Answer – A wire gauge.</i>	JSAT 7-54
8	What color are the navigation lights on the wingtips? <i>Answer – The left wingtip is red, the right is green.</i>	JSAT 7-54
9	Name several types of electrical devices that would be considered intermittent loads on an electrical system. <i>Answer – Landing gear, cowl and wing flap motors, radio transmitters.</i>	JSAT 7-54
10.	Why would it be necessary to analyze an electrical system before increasing the load on the system? <i>Answer – To determine that the generator capacity, wire size, and protective device capacity will not be exceeded.</i>	JSAT 7-55
11	What factors should be considered when determining the wire size for a particular application? <i>Answer – The system voltage, permissible voltage drop, current to be carried, wire length and whether the load is continuous or intermittent.</i>	JSAT 7-55
12	What is the relationship between the inside diameter of a conduit and the outside diameter of the wire bundle inside it? <i>Answer – The conduit must be 25% larger than the wire bundle.</i>	JSAT 7-59
13	What is the maximum number of terminal lugs that can be placed on a single terminal strip stud? <i>Answer – Four</i>	JSAT 7-63

Chapter 7 — Airframe Electrical Systems

Q #	Question and Answer	Page Reference
14	What is the proper length for a bonding jumper? <i>Answer – As short as practical, but long enough to allow free movement of the component.</i>	JSAT 7-64
15	Under what conditions must a switch be derated from its nominal rating? <i>Answer – When used with inductive circuits, circuits with high in-rush current, and with DC motors.</i>	JSAT 7-66
16	At what point do electric motors draw the most current? <i>Answer – When starting.</i>	JSAT 7-66
17	Circuit breakers are designed to open before what condition occurs? <i>Answer – Before the wire emits smoke.</i>	JSAT 7-69
18	At what point in a circuit should the protective device be located? <i>Answer – As close to the power source as possible.</i>	JSAT 7-69
19	What type of circuit breaker may not be used in an aircraft? <i>Answer – An automatic resetting type.</i>	JSAT 7-71
20	What part of an aircraft is identified by a white navigation light? <i>Answer – The tail.</i>	JSAT 7-72
21	What could cause an AC electric motor to run too slowly? <i>Answer – Lack of lubrication, defective wiring, or low applied voltage.</i>	JSAT 7-86
22	What should be done when making bonding or grounding connections between dissimilar materials? <i>Answer – Use a suitable washer so that any corrosion will occur on the washer.</i>	JSGT 12-28 AC 43.13-1B
23	Prior to making a continuity check, what must be done to an electrical circuit? <i>Answer – The power must be turned off.</i>	JSGT 3-95

Chapter 7 — Airframe Electrical Systems

Project #	Project Description	Level
1	<p>Project: Select and install open wiring.</p> <p>Given: A selection of wire, tools, reference material, and an aircraft or mockup with a missing wire.</p> <p>Performance Standard: The applicant will determine the electrical load, select the correct wire size, and install the missing wire.</p>	3
2	<p>Project: Select and install an electrical switch.</p> <p>Given: A selection of switches, an electrical load, tools, reference material, and an aircraft or mockup electrical system.</p> <p>Performance Standard: The applicant will select an appropriate switch and install it.</p>	3
3	<p>Project: Select and install a circuit breaker and/or fuse.</p> <p>Given: A selection of circuit breakers and/or fuses, an electrical load, tools, reference material, and an aircraft or mockup electrical system.</p> <p>Performance Standard: The applicant will select an appropriate circuit breaker and/or fuse and install it.</p>	3
4	<p>Project: Secure a wire bundle.</p> <p>Given: An unsecured wire bundle in an aircraft or mockup, cord, clamps, tools, and reference material.</p> <p>Performance Standard: The applicant will secure the wire bundle with cord and clamps.</p>	3
5	<p>Project: Determine electrical loads.</p> <p>Given: A circuit diagram or drawing, a specific circuit, and reference material.</p> <p>Performance Standard: The applicant will analyze the circuit and determine its load under normal conditions.</p>	2
6	<p>Project: Install bonding jumpers.</p> <p>Given: Electrical components without bonding jumpers, a selection of bonding jumpers, tools, and reference material.</p> <p>Performance Standard: The applicant will select and install bonding jumpers on each assigned component.</p>	3
7	<p>Project: Splice copper electrical wire.</p> <p>Given: Samples of copper wire, insulated splices, tools, and reference material.</p> <p>Performance Standard: The applicant will splice wires as assigned.</p>	3
8	<p>Project: Check the output voltage of a DC generator.</p> <p>Given: An operable DC generator on an aircraft, test stand or mockup, test equipment, and reference material.</p> <p>Performance Standard: The applicant will operate the DC generator, test its output voltage, and determine if it is within prescribed limits.</p>	3

Chapter 7 — Airframe Electrical Systems

Project #	Project Description	Level
9	<p>Project: Adjust a voltage regulator.</p> <p>Given: An operable DC generator system that is not within limits and reference material.</p> <p>Performance Standard: The applicant will adjust the voltage regulator to bring the generator voltage within the prescribed limits.</p>	3
10	<p>Project: Troubleshoot an electrical circuit with an open defect and with a short defect.</p> <p>Given: Electrical circuits with open and short defects, test equipment, and reference material.</p> <p>Performance Standard: The applicant will use the test equipment to locate the open and short defects.</p>	3
11	<p>Project: Measure the resistance in an electrical system component.</p> <p>Given: An electrical system component, test equipment, and reference material.</p> <p>Performance Standard: The applicant will use the test equipment to determine the resistance of the specified component.</p>	3
12	<p>Project: Check the spring tension on generator brushes.</p> <p>Given: A generator, tools, and reference material.</p> <p>Performance Standard: The applicant will check the generator brush spring tension and determine if it is within prescribed limits.</p>	3
13	<p>Project: Check and inspect anti-collision and position lights.</p> <p>Given: An aircraft with anti-collision and position lights, and reference material.</p> <p>Performance Standard: The applicant will operate the anti-collision and position lights and determine the condition of the system.</p>	3
14	<p>Project: Check and inspect a landing light.</p> <p>Given: An aircraft with landing lights, and reference material.</p> <p>Performance Standard: The applicant will operate the landing lights and determine the condition of the system.</p>	3
15	<p>Project: Identify various components in an electrical system.</p> <p>Given: A schematic of an electrical system and reference material.</p> <p>Performance Standard: The applicant will label the components of the assigned electrical system.</p>	2
16	<p>Project: Repair a cockpit lighting circuit.</p> <p>Given: An aircraft or mockup of a cockpit lighting circuit containing a defect, tools, and reference material.</p> <p>Performance Standard: The applicant will locate and repair a fault in a cockpit lighting circuit.</p>	3

Chapter 7 — Airframe Electrical Systems

Project #	Project Description	Level
17	<p>Project: Troubleshoot a DC electrical system supplied by an AC electrical system.</p> <p>Given: A schematic of the system, actual or simulated pilot reports, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
18	<p>Project: Identify the components in an electrical schematic where AC current is rectified to DC current.</p> <p>Given: A system schematic and reference material.</p> <p>Performance Standard: The applicant will label all the components and trace the path of the supplied AC current that is rectified to DC current.</p>	2

NOTES

Chapter 8 — Hydraulic and Pneumatic Power Systems

Q #	Question and Answer	Page Reference
1	What materials form the bases of the three types of hydraulic fluids? <i>Answer – Vegetable, mineral, and phosphate-esters.</i>	JSAT 8-7
2	What colors denote mineral-based and phosphate-ester-based hydraulic fluids? <i>Answer – Mineral based fluids are red and phosphate-ester based fluids are light purple.</i>	JSAT 8-7
3	What are the results of exposing lacquers, oil-based paint, plastic resins, and vinyl compounds to phosphate-ester-based hydraulic fluid? <i>Answer – The materials will be damaged and/or softened, or the paint will peel.</i>	JSAT 8-8
4	Name several sources used to develop hydraulic pressure? <i>Answer – Hand pumps, engine-driven pumps, and electrically driven pumps.</i>	JSAT 8-12, 8-15
5	What would cause the bypass valve in a hydraulic filter to open and allow unfiltered fluid to circulate in the system? <i>Answer – A clogged filter element.</i>	JSAT 8-14
6	Describe several methods of pressurizing a hydraulic reservoir. <i>Answer – Engine bleed air, system pressure acting on a small piston in the reservoir, using variable-displacement hydraulic pumps.</i>	JSAT 8-16
7	What feature prevents engine damage if an engine-driven hydraulic pump seizes or is overloaded? <i>Answer – A shear section in the pump driveshaft will break, disconnecting the pump from the engine.</i>	JSAD 397
8	Describe the purpose of a pressure relief valve. <i>Answer – Pressure relief valves limit the maximum pressure produced by the pump, thereby preventing failures of the system components.</i>	JSAT 8-23
9	Engine-driven pumps deliver the output fluid flow in what two forms? <i>Answer – As a constant volume or a variable volume.</i>	JSAT 8-23
10	Describe the operation of a gear-type pump? <i>Answer – Two meshed gears, driven by a power source, rotate in a housing. Inlet fluid is carried around the outside of the gears and delivered to the outlet side as the gears rotate.</i>	JSAT 8-24
11	Describe the purpose of a pressure regulator? <i>Answer – Pressure regulators manage the output of the pump to maintain system pressure. They allow the pump to be unloaded so it turns without significant resistance.</i>	JSAT 8-35
12	What is the device that is used in some systems to supplement the pump output during periods of high demand? <i>Answer – An accumulator.</i>	JSAT 8-36

Chapter 8 — Hydraulic and Pneumatic Power Systems

Q #	Question and Answer	Page Reference
13	What are the three different types of accumulators? <i>Answer – Piston, diaphragm, and bladder.</i>	JSAT 8-37
14.	What safety precautions must be taken prior to disassembling an accumulator? <i>Answer – Release all of the air or preload.</i>	JSAT 8-38
15	When a hydraulic unit is replaced, what precautions should be taken to avoid contamination of the system? <i>Answer – All lines should be capped or plugged immediately after they are disconnected.</i>	JSAT 8-39
16	What types of components or systems are pneumatically operated in some aircraft? <i>Answer – Landing gear, brakes, flaps, and other mechanical actuators.</i>	JSAT 8-49
17	Name several sources of pneumatic power? <i>Answer – Storage bottles, engine bleed air, engine-driven compressors or vane-type pumps.</i>	JSAT 8-49
18	What happens to excess pressure in a pneumatic system? <i>Answer – A relief valve vents it overboard.</i>	JSAT 8-53
19	What is the function of a restrictor in a pneumatic system? <i>Answer – To control the rate of flow of the JSAT.</i>	JSAT 8-54
20	What are the reasons for periodically purging a pneumatic system? <i>Answer – To remove moisture and contaminants.</i>	JSAT 8-58

Chapter 8 — Hydraulic and Pneumatic Power Systems

Project #	Project Description	Level
1	<p>Project: Identify different types of hydraulic fluids.</p> <p>Given: Samples of synthetic, vegetable, and petroleum-based fluids.</p> <p>Performance Standard: The applicant will identify each sample by color or other identifying features.</p>	2
2	<p>Project: Identify packing seals.</p> <p>Given: Samples of packing seals and reference material.</p> <p>Performance Standard: The applicant will identify the samples and determine their compatibility with different types of hydraulic fluids.</p>	2
3	<p>Project: Install seals in a hydraulic component.</p> <p>Given: A hydraulic component, seals, tools, and reference material.</p> <p>Performance Standard: The applicant will install the proper seals in the hydraulic component according to the type of fluid used.</p>	3
4	<p>Project: Remove and install a selector valve.</p> <p>Given: An aircraft or mockup, tools, and reference material.</p> <p>Performance Standard: The applicant will identify, remove, and reinstall the hydraulic selector valve.</p>	3
5	<p>Project: Perform an operational check on a pressure regulator and adjust as necessary.</p> <p>Given: A hydraulic system with a pressure regulator, tools, and reference material.</p> <p>Performance Standard: The applicant will check the operation of the regulator and adjust it, if required, according to the manufacturer's instructions.</p>	3
6	<p>Project: Remove, clean, and install a filter in a hydraulic system.</p> <p>Given: A hydraulic system with a filter, tools, and reference material.</p> <p>Performance Standard: The applicant will remove, clean, and reinstall an aircraft hydraulic filter using the proper tools and procedures as detailed in the aircraft manufacturer's service manual.</p>	3
7	<p>Project: Service a hydraulic system reservoir and accumulator.</p> <p>Given: A hydraulic system with an accumulator and reservoir, necessary equipment and tools, and reference material.</p> <p>Performance Standard: The applicant will check the air preload on the accumulator, service it as required, and fill the reservoir with the proper fluid.</p>	3
8	<p>Project: Remove, install, and check an engine-driven hydraulic pump.</p> <p>Given: An aircraft or mockup with an engine-driven pump, tools, and reference material.</p> <p>Performance Standard: The applicant will remove, install, and operationally check the hydraulic pump and system.</p>	3
9	<p>Project: Troubleshoot hydraulic system malfunctions.</p> <p>Given: Actual or simulated pilot reports of system malfunctions, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the reported malfunctions.</p>	3

Chapter 8 — Hydraulic and Pneumatic Power Systems

Project #	Project Description	Level
10	<p>Project: Purge air from a hydraulic system.</p> <p>Given: An aircraft or mockup hydraulic system, tools, and reference material.</p> <p>Performance Standard: The applicant will purge air from the system.</p>	3
11	<p>Project: Remove and install a pressure relief valve in a hydraulic system.</p> <p>Given: An aircraft or mockup hydraulic system, tools, and reference material.</p> <p>Performance Standard: The applicant will locate, remove, and install the system pressure relief valve.</p>	3
12	<p>Project: Troubleshoot a report of low operating pressure and/or fluctuating pressure in hydraulic power system.</p> <p>Given: Actual or simulated pilot reports and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the low and/or fluctuating system pressure.</p>	3
13	<p>Project: Troubleshoot a leaking hydraulic power system.</p> <p>Given: A hydraulic power system with a leak, tools, and reference material.</p> <p>Performance Standard: The applicant will locate the fluid leak and determine the proper corrective action.</p>	3
14	<p>Project: Inspect a pneumatic brake system air bottle for condition, determine its service life, and service the air bottle.</p> <p>Given: A pneumatic brake system air bottle, necessary tools and equipment, and reference material.</p> <p>Performance Standard: The applicant will determine the condition of the bottle, determine if the bottle meets the hydrostatic test requirements, and service the air bottle to the correct system pressure.</p>	3
15	<p>Project: Check the operation of a pneumatic brake system.</p> <p>Given: A pneumatic brake system and reference material.</p> <p>Performance Standard: The applicant will operate the brake system and verify its proper operation.</p>	3
16	<p>Project: Troubleshoot a pneumatic power system.</p> <p>Given: Actual or simulated pilot reports and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
17	<p>Project: Adjust a pneumatic power system relief valve.</p> <p>Given: An aircraft or mockup with a pneumatic power system, tools, and reference material.</p> <p>Performance Standard: The applicant will adjust the relief valve in accordance with the instructions supplied.</p>	3

Chapter 9 — Aircraft Landing Gear Systems

Q #	Question and Answer	Page Reference
1	What is the purpose of a torque link on an oleo strut? <i>Answer – To keep the wheel in alignment and prevent the piston from coming out of the cylinder.</i>	JSAT 9-4
2	A landing gear shock strut should be inflated with what gas(es)? <i>Answer – Nitrogen or dry air.</i>	JSAT 9-5
3	What conditions should a mechanic look for during a regular inspection of the exposed piston section of a landing gear? <i>Answer – Cleanliness, evidence of damage, and proper extension.</i>	JSAT 9-5
4	What prevents air from leaking out between the two halves of a split wheel assembly? <i>Answer – An O-ring.</i>	JSAT 9-6
5	Why are fusible plugs installed on some aircraft wheels? <i>Answer – To release the pressure generated by heat build-up before a tire blows.</i>	JSAT 9-6
6	What safety precaution must be taken when removing a wheel from an axle or when disassembling a wheel? <i>Answer – Verify that the tire is completely deflated before removing a wheel from an axle or before wheel disassembly.</i>	JSAT 9-7
7	What are the visible signs of excessive heating on a wheel bearing? <i>Answer – The bearing surfaces show discoloration.</i>	JSAT 9-8
8	How are the pilot's nose wheel steering commands transmitted to the steering control unit of a large aircraft? <i>Answer – Steering signals may be transmitted mechanically, electrically, or hydraulically.</i>	JSAT 9-11
9	How is the nose wheel steering mechanism usually actuated on a small aircraft? <i>Answer – By means of a mechanical linkage connected to the rudder pedals.</i>	JSAT 9-11
10	What is the name of the unit that prevents a nose wheel from vibrating or oscillating? <i>Answer – A shimmy damper</i>	JSAT 9-12
11	What are the most common sources of power used to extend and retract landing gear? <i>Answer – Hydraulic pressure and electric motors.</i>	JSAT 9-14
12	At what times should a gear retraction check be performed? <i>Answer – During annual or other inspections and following a hard landing.</i>	JSAT 9-17
13	What mechanism(s) ensure that a nose wheel is not turned as it retracts into its wheelwell? <i>Answer – Internal centering cams in the strut or an external track.</i>	JSAT 9-17
14	Name several types of brake actuating systems? <i>Answer – Independent master cylinders, boosted brakes, and power-controlled brakes.</i>	JSAT 9-25, 9-27

Chapter 9 — Aircraft Landing Gear Systems

Q #	Question and Answer	Page Reference
15	What is the function of an anti-skid system? <i>Answer – Anti-skid systems allow large aircraft to achieve maximum braking effectiveness without allowing wheels to skid or lock.</i>	JSAT 9-27
16	What is the purpose of a deboosters? <i>Answer – To reduce hydraulic system high pressure to a lower value for more satisfactory brake action.</i>	JSAT 9-28
17	Describe two methods of bleeding brakes. <i>Answer – A pressure pot can be attached to the bleeder valve and fluid forced back towards the master cylinder and/or reservoir, or the master cylinder can be used for forcing fluid from the reservoir to the brakes.</i>	JSAT 9-32
18	Before a brake system can be inspected for leaks, what action must be accomplished? <i>Answer – Pressure must be applied to the system.</i>	JSAT 9-33
19	What maintenance function has the greatest impact on tire service life? <i>Answer – Ensuring that the tires are properly inflated.</i>	JSAT 9-43
20	What effect(s) does under-inflation have on aircraft tires? <i>Answer – Internal heat damage possibly leading to premature tire failure, and more tread wear on the shoulders than in the center.</i>	JSAT 9-43

Chapter 9 — Aircraft Landing Gear Systems

Project #	Project Description	Level
1	<p>Project: Service a landing gear air/oil shock strut</p> <p>Given: An aircraft or a mockup with an operational shock strut, tools, and reference material.</p> <p>Performance Standard: The applicant will deflate a shock strut, check the fluid level and service the fluid if necessary, and inflate the strut to the proper air pressure using the reference material as a guide.</p>	3
2	<p>Project: Troubleshoot and bleed any air from a hydraulic brake system.</p> <p>Given: An aircraft or mockup with a hydraulic brake, actual or simulated pilot reports of brake system malfunctions, tools, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports, determine possible causes, list possible corrective actions, and bleed a hydraulic brake until it is free of any air.</p>	3
3	<p>Project: Perform a landing gear retraction check.</p> <p>Given: An aircraft or mockup with retractable landing gear, required equipment and tools, and reference material.</p> <p>Performance Standard: The applicant will perform an operational check of the gear retraction system and determine if adjustments are required.</p>	3
4	<p>Project: Remove, inspect, service, and reinstall a wheel and tire assembly.</p> <p>Given: An aircraft or mockup with a wheel assembly installed on an axle, tools, and reference material.</p> <p>Performance Standard: The applicant will remove the wheel assembly from the axle, inspect the wheel assembly and bearings, clean and lubricate the bearings, and reinstall the wheel assembly.</p>	3
5	<p>Project: Demount, inspect, reinstall and balance a tire on a wheel assembly.</p> <p>Given: An aircraft tire and wheel assembly, tools, and reference material.</p> <p>Performance Standard: The applicant will demount the tire from the wheel, inspect the tire, and remount it on the wheel and balance the tire and wheel assembly.</p>	3
6	<p>Project: Remove, inspect, replace the brake pads or linings, and reinstall a wheel brake assembly.</p> <p>Given: An aircraft or mockup with a wheel brake assembly, tools, and reference material.</p> <p>Performance Standard: The applicant will remove the wheel brake assembly, perform the inspections required by the reference material, list any defects, replace the brake pads or linings, and reinstall the wheel brake assembly.</p>	3
7	<p>Project: Inspect samples of tires and determine their condition.</p> <p>Given: Tire samples and reference material.</p> <p>Performance Standard: The applicant will select which of the tire samples are airworthy and which are not in accordance with the reference material.</p>	3

Chapter 9 — Aircraft Landing Gear Systems

Project #	Project Description	Level
8	<p>Project: Repair a defective tube-type tire.</p> <p>Given: A tube-type tire with a leak, a replacement tube, necessary equipment, and reference material.</p> <p>Performance Standard: The applicant will remove the tube from the tire, replace the tube, reassemble the tire and wheel, inflate the tube to the proper pressure, and check for leaks.</p>	3
9	<p>Project: Describe the proper procedures for storing tires.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will list the conditions required for proper storage of aircraft tires.</p>	1
10	<p>Project: Replace the valve core in a tire or tube.</p> <p>Given: A tubeless or tube-type tire and wheel assembly, a valve core, tools, and reference material.</p> <p>Performance Standard: The applicant will remove the valve core, replace it with a new one, inflate the tire to the correct pressure, and check for leaks.</p>	3
11	<p>Project: Replace the air valve in an air/oil shock strut.</p> <p>Given: A shock strut, air valve, tools, and reference material.</p> <p>Performance Standard: The applicant will remove the shock strut air valve, install a serviceable valve, properly inflate the strut and check for leaks.</p>	3
12	<p>Project: Troubleshoot an air/oil shock strut and/or a landing gear retraction system.</p> <p>Given: Actual or simulated pilot reports of malfunctions, an air/oil shock strut and/or landing gear retraction system, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports, and determine the probable cause of the malfunctions.</p>	3
13	<p>Project: Service a nose wheel shimmy damper.</p> <p>Given: A shimmy damper, necessary equipment, and reference material.</p> <p>Performance Standard: The applicant will service the shimmy damper.</p>	3
14	<p>Project: Troubleshoot and adjust a nose wheel steering system.</p> <p>Given: An aircraft with nose wheel steering, actual or simulated pilot reports of malfunctions, tools, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports, determine the probable cause of the reported malfunctions, and adjust the steering travel.</p>	3
15	<p>Project: Inspect the alignment of landing gear.</p> <p>Given: An aircraft, necessary equipment, and reference material.</p> <p>Performance Standard: The applicant will measure the landing gear alignment and determine if it is within the limits specified in the reference material.</p>	3
16	<p>Project: Replace the packings and/or seals in a master brake cylinder.</p> <p>Given: A master brake cylinder, seals, tools, and reference material.</p> <p>Performance Standard: The applicant will install the required seals in the master brake cylinder.</p>	3

Chapter 10 — Position and Warning Systems

Q #	Question and Answer	Page Reference
1	What unit in an anti-skid system generates the anti-skid warning signal? <i>Answer — The control unit.</i>	JSAT 10-5
2	How is a pilot alerted that an anti-skid system has automatically returned to a manual brake system? <i>Answer — By a warning light.</i>	JSAT 10-6
3	What is the significance of an anti-skid warning? <i>Answer — The system is off or has failed.</i>	JSAT 10-6
4	By what usual means does the stall warning system in a small aircraft alert the pilot of an impending stall? <i>Answer — An audible alert and/or a warning light.</i>	JSAT 10-9
5	What devices are used to provide warnings for a retractable landing gear system? <i>Answer — A horn or other aural device, and a red warning light or lights.</i>	JSAT 10-12
6	How can a pilot determine that the landing gear is down and locked? <i>Answer — A green light or lights and/or another type of visual indicator.</i>	JSAT 10-12
7	Name at least two conditions that would activate a takeoff configuration warning system in a jet transport aircraft. <i>Answer — Incorrect leading or trailing edge flap position, stabilizer position, or speed brake not stowed. The manufacturer may establish other conditions.</i>	JSAT 10-12
8	What landing gear positions must be indicated by regulations? <i>Answer — Down and locked and up and locked.</i>	JSAT 10-12
9	Under what conditions will a landing gear aural warning sound? <i>Answer — When the throttle is retarded and the landing gear is not down and locked.</i>	JSAT 10-12
10	How does a takeoff configuration warning differ from a landing gear warning? <i>Answer — Takeoff warnings are usually an intermittent horns while landing gear warnings are steady.</i>	JSAT 10-12
11	What is the function of a Mach airspeed warning system? <i>Answer — To alert the pilot that the never-exceed airspeed limit has been reached or exceeded.</i>	JSAT 10-13
12	What systems are commonly used to activate the landing gear warning systems? <i>Answer — The throttles (thrust levers) and the wing flaps.</i>	JSAT 10-13
13	Why do airplanes with bleed air anti-icing of the wing leading edge have an anti-ice overheat light(s)? <i>Answer — To indicate an over-temperature condition, usually as the result of a break in the bleed air ducts.</i>	JSAT 13-4

Chapter 10 — Position and Warning Systems

Q #	Question and Answer	Page Reference
14	What warning system may be required when a nickel-cadmium battery is installed in an aircraft? <i>Answer — A battery temperature monitoring system.</i>	JSAT 7-31
15	At what time would a check of a landing gear warning system normally be made? <i>Answer — During a landing gear retraction test.</i>	JSAT 9-17
16	What is the purpose of an annunciator system? <i>Answer — To show, by means of a warning light, that some system parameter requires attention by the flight crew.</i>	JSDictionary
17	If an aircraft with retractable landing gear has only one green light to indicate the gear is down and locked, how will the switches be connected, in series or in parallel? <i>Answer — In series.</i>	JSGT 3-102
18	Where would you locate the procedures for checking and adjusting the landing gear switches? <i>Answer — In the aircraft manufacturer's manual.</i>	JSGT 14-12
19	What is the usual means for alerting the crew of a jet transport that the cabin doors are not properly closed? <i>Answer — A warning light.</i>	JSAI 98
20	Why are transport category aircraft equipped with a master caution and warning system? <i>Answer — To alert the crew that a malfunction has occurred and corrective action may be required.</i>	JSAI 98

Chapter 10 — Position and Warning Systems

Project #	Project Description	Level
1	<p>Project: Identify the components in a landing gear position indicating and/or warning system.</p> <p>Given: An aircraft or mockup and reference material.</p> <p>Performance Standard: The applicant will point out the components in the landing gear position indicating and/or warning system.</p>	2
2	<p>Project: Troubleshoot a landing gear position indicating and/or warning system.</p> <p>Given: Actual or simulated pilot reports, a system schematic, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction(s).</p>	3
3	<p>Project: Locate the procedures for checking and troubleshooting an anti-skid warning system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the relevant procedures.</p>	1
4	<p>Project: Locate the procedures for troubleshooting a Mach airspeed warning system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the relevant procedures.</p>	1
5	<p>Project: Locate the procedures for troubleshooting a takeoff airspeed warning system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the relevant procedures.</p>	1
6	<p>Project: Inspect a landing gear position indicating system.</p> <p>Given: An aircraft or mockup and reference material.</p> <p>Performance Standard: The applicant will inspect the landing gear position indicating system and determine the condition of the wiring and system components.</p>	3
7	<p>Project: Repair a landing gear position indicating system.</p> <p>Given: An aircraft or mockup with a malfunctioning landing gear position indicating system and reference material.</p> <p>Performance Standard: The applicant will locate and repair a malfunction in the landing gear position indicating system to an operating condition.</p>	3
8	<p>Project: Explain the operating sequence of a landing gear warning system.</p> <p>Given: An electrical schematic and reference material.</p> <p>Performance Standard: The applicant will explain the electrical switch operating sequence and what each switch does for the complete landing gear cycle.</p>	2
9	<p>Project: Determine the adjustment procedures for a flap position warning and/or stall warning system.</p> <p>Given: The manufacturer's maintenance manual and schematic drawings.</p> <p>Performance Standard: The applicant will locate the adjustment procedures of the assigned system or systems.</p>	1

Chapter 10 — Position and Warning Systems

Project #	Project Description	Level
10	<p>Project: Remove, install, and adjust a landing gear down-lock switch.</p> <p>Given: An aircraft or mockup and reference material.</p> <p>Performance Standard: The applicant will locate, remove, install, and adjust a landing gear down-lock switch.</p>	3
11	<p>Project: Inspect the rigging and adjustment of a landing gear up-lock.</p> <p>Given: An aircraft or mockup with an out-of-adjustment landing gear up-lock and reference material.</p> <p>Performance Standard: The applicant will inspect the rigging, make the required adjustment(s), and make an appropriate entry in the aircraft maintenance records.</p>	3
12	<p>Project: Locate the procedures for checking a pneumatic/bleed air overheat warning system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the procedures for checking the assigned system.</p>	1
13	<p>Project: Test an annunciator panel and master caution/warning system.</p> <p>Given: An aircraft or mockup with an annunciator panel and reference material.</p> <p>Performance Standard: The applicant will test the annunciator panel and master caution/warning system.</p>	3
14	<p>Project: Perform a ground test of an anti-skid system.</p> <p>Given: An aircraft or mockup with an annunciator panel anti-skid system</p> <p>Performance Standard: The applicant will perform a ground test of the anti-skid system to determine its operational condition.</p>	3
15	<p>Project: Locate the troubleshooting procedures for a flap position indicating system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the procedures for troubleshooting the flap position indicator.</p>	1
16	<p>Project: Repair a flap position indicating system.</p> <p>Given: An aircraft or mockup with a malfunctioning flap position indicator.</p> <p>Performance Standard: The applicant will locate and correct the malfunction.</p>	3

Chapter 11 — Aircraft Instrument Systems

Q #	Question and Answer	Page Reference
1	A static check may be performed on a manifold pressure gauge by using what piece of information? <i>Answer – Current atmospheric pressure.</i>	JSAT 11-6
2	What aircraft instrument can be used to check a manifold pressure gauge for proper indication? <i>Answer – The sensitive altimeter.</i>	JSAT 11-6
3	Name several of the indication errors that may be found in altimeters. <i>Answer – Scale errors, hysteresis, friction, installation.</i>	JSAT 11-9
4	What is the signal source in an electrical resistance-type temperature indicating system? <i>Answer – A temperature bulb or sensing element.</i>	JSAT 11-14
5	What type of temperature sensing system is normally used to measure a turbine engine exhaust gas temperature? <i>Answer – A thermocouple-type system.</i>	JSAT 11-15
6	What operating parameter is indicated by a tachometer? <i>Answer – Engine RPM (i.e. crankshaft or turbine rotor speed).</i>	JSAT 11-16
7	What is the name of the effect that causes a gyro to respond to an applied force at a point 90 degrees further in the direction of rotation? <i>Answer – Gyroscopic precession</i>	JSAT 11-17
8	What are the three sources of power used to drive a gyroscopic turn indicator? <i>Answer – Air from a vacuum or pressure source, or an electric motor.</i>	JSAT 11-20, 11-30
9	What are two items that should be considered during inspection of a magnetic compass? <i>Answer –</i> <ol style="list-style-type: none"><i>1. The fluid must be clear.</i><i>2. The housing must be full with no bubbles.</i><i>3. The card must be legible and the lubber line intact.</i><i>4. The compass should be properly calibrated.</i>	JSAT 11-22
10	In what way do magnetic fields generated by electrical equipment and steel parts in the airplane affect a magnetic compass? <i>Answer – Stray magnetic fields deflect the compass from correct alignment with the earth's magnetic field.</i>	JSAT 11-24
11	Describe the basic operating concept of a synchro-type remote indicating system. <i>Answer – A remote transmitter electrically signals a receiver inside the instrument.</i>	JSAT 11-25
12	What aircraft instruments are connected to the pitot-static system? <i>Answer – The altimeter, vertical speed indicator, airspeed and mach meter in high-performance jets.</i>	JSAT 11-30

Chapter 11 — Aircraft Instrument Systems

Q #	Question and Answer	Page Reference
13	<p>Why should you avoid cleaning obstructions from the sensing holes in a pitot-static system with a tool?</p> <p><i>Answer – The holes are aerodynamically critical.</i></p>	JSAT 11-31
14	<p>After components in a pitot-static system have been replaced, what tests or inspections are required?</p> <p><i>Answer – The static system leak test specified by FAR 91.411.</i></p>	JSAT 11-32
15	<p>What quantity is accurately measured by a capacitance-type fuel quantity indicating system?</p> <p><i>Answer – The mass of the fuel.</i></p>	JSAT 11-34
16	<p>Who is authorized to apply the range markings to an instrument dial face?</p> <p><i>Answer – The manufacturer or a certificated instrument repair station.</i></p>	JSAT 11-45
17	<p>What is the purpose of a slippage mark on an instrument glass?</p> <p><i>Answer – To indicate if the glass has moved, which could cause incorrect range markings on an instrument that has the range markings painted on the glass.</i></p>	JSAT 11-45
18	<p>What references should be consulted to determine the proper range markings for aircraft instruments?</p> <p><i>Answer – The aircraft maintenance manual, aircraft flight manual, Type Certificate Data Sheets or Aircraft Specifications.</i></p>	JSAT 11-45 JSGT 14-8
19	<p>What is the meaning of a yellow arc on an aircraft instrument?</p> <p><i>Answer – A caution or limited flight operations range.</i></p>	JSAT 11-46
20	<p>What is the reason for “swinging” a compass and how is it accomplished?</p> <p><i>Answer – To compensate for deviations, caused by magnetic fields in the aircraft, by adjusting the compensating magnets.</i></p>	JSAT 11-48

Chapter 11 — Aircraft Instrument Systems

Project #	Project Description	Level
1	<p>Project: Remove and install instruments.</p> <p>Given: An aircraft, tools, and reference material.</p> <p>Performance Standard: The applicant will remove and install instruments as specified.</p>	2
2	<p>Project: Inspect range markings on aircraft instruments.</p> <p>Given: Instruments with range markings and reference material.</p> <p>Performance Standard: The applicant will inspect the assigned instruments and determine if the range marks are correct.</p>	2
3	<p>Project: Find barometric pressure using an altimeter.</p> <p>Given: A sensitive altimeter and reference material.</p> <p>Performance Standard: The applicant will adjust the altimeter to field elevation and read the local barometric pressure from the barometric scale.</p>	2
4	<p>Project: Check the operation of a pitot-static heater.</p> <p>Given: An aircraft with an electrically heated pitot-static system and reference material.</p> <p>Performance Standard: The applicant will check the system operation.</p>	2
5	<p>Project: Check a manifold pressure indicator for proper indication.</p> <p>Given: An aircraft with a manifold pressure gauge and reference material.</p> <p>Performance Standard: The applicant will compare the field barometric pressure with the static manifold pressure indication.</p>	2
6	<p>Project: Perform a pitot-static system leak check.</p> <p>Given: A pitot-static system, test equipment, and reference material.</p> <p>Performance Standard: The applicant will test the pitot-static system and determine if there are any leaks.</p>	3
7	<p>Project: Apply a slippage mark to an instrument glass.</p> <p>Given: An instrument with range marks on the glass cover, necessary equipment, and reference material.</p> <p>Performance Standard: The applicant will determine if the range marks are in the proper position and apply a slippage mark.</p>	2
8	<p>Project: Swing a compass.</p> <p>Given: An aircraft, access to a compass rose, and reference material.</p> <p>Performance Standard: The applicant will swing the compass and determine if the compass correction card needs updating.</p>	3
9	<p>Project: Inspect a magnetic compass.</p> <p>Given: A magnetic compass and reference material.</p> <p>Performance Standard: The applicant will inspect the magnetic compass and list any defects.</p>	3

Chapter 11 — Aircraft Instrument Systems

Project #	Project Description	Level
10	<p>Project: Troubleshoot a vacuum operated turn indicator.</p> <p>Given: Actual or simulated pilot reports, a turn indicator system, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
11	<p>Project: Troubleshoot an electric attitude indicator.</p> <p>Given: Actual or simulated pilot reports, an electric attitude indicator system, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
12	<p>Project: Select an altimeter for installation in a specific aircraft.</p> <p>Given: Several different altimeters and reference material.</p> <p>Performance Standard: The applicant will review the reference material and select the approved altimeter for the specified installation.</p>	2
13	<p>Project: Troubleshoot a synchro-type indicating system.</p> <p>Given: Actual or simulated pilot reports, a synchro-type indicator system, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
14	<p>Project: Remove and install a vacuum pump.</p> <p>Given: An aircraft or mockup and reference material.</p> <p>Performance Standard: The applicant will remove and install the vacuum pump.</p>	3
15	<p>Project: Remove and install a heated pitot tube.</p> <p>Given: An aircraft or mockup and reference material.</p> <p>Performance Standard: The applicant will remove and install the pitot tube.</p>	3
16	<p>Project: Identify turbine engine EGT system components.</p> <p>Given: An EGT system and reference material.</p> <p>Performance Standard: The applicant will point out the indicator, wiring, and thermocouples.</p>	2
17	<p>Project: Troubleshoot an electrical resistance-type thermometer system.</p> <p>Given: Actual or simulated pilot reports, an electrical resistance-type thermometer system, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
18	<p>Project: Service the filter(s) in a vacuum system.</p> <p>Given: An aircraft or mockup with a vacuum system, tools, and reference material.</p> <p>Performance Standard: The applicant will service the vacuum system by cleaning and/or replacing the filter(s).</p>	3

Chapter 11 — Aircraft Instrument Systems

Project #	Project Description	Level
19	<p>Project: Check an altimeter system to determine if it meets the requirements for IFR (Instrument Flight Rules) certification.</p> <p>Given: Aircraft maintenance records.</p> <p>Performance Standard: The applicant will review the maintenance records and determine if the required checks have been made and the system certified within the required time period.</p>	2
20	<p>Project: Inspect an aircraft vacuum system.</p> <p>Given: A manufacturer's service manual, an inspection form, and reference material.</p> <p>Performance Standard: The applicant will inspect the filter, hoses, connections, regulator, and system integrity.</p>	3
21	<p>Project: Adjust gyro/instrument air pressure.</p> <p>Given: An aircraft or mockup, test equipment, and reference material.</p> <p>Performance Standard: The applicant will determine the recommended pressure value and adjust the system accordingly.</p>	3
22	<p>Project: Inspect and/or troubleshoot a cylinder head temperature indicating system.</p> <p>Given: A cylinder head temperature indicating system and reference material.</p> <p>Performance Standard: The applicant will inspect and/or troubleshoot the system as required.</p>	3
23	<p>Project: Troubleshoot a malfunction in a directional gyro system.</p> <p>Given: A directional gyro system and reference material.</p> <p>Performance Standard: The applicant will determine the cause of the malfunction.</p>	3
24	<p>Project: Locate the alternate air source on an aircraft.</p> <p>Given: An aircraft and reference material.</p> <p>Performance Standard: The applicant will locate the alternate air source.</p>	2

NOTES

Chapter 12 — Aircraft Avionics Systems

Q #	Question and Answer	Page Reference
1	What are the basic components of a radio communication system? <i>Answer – A microphone, transmitter, transmitting and receiving antennas, receiver, and speaker or headphones.</i>	JSAT 12-6
2	What frequency range is used by most modern voice communications systems? <i>Answer – The VHF (Very High Frequency) band (118.0 to 136.975 MHz).</i>	JSAT 12-10
3	What does the term “ADF” stand for? <i>Answer – Airborne Direction Finding (Finder)</i>	JSAT 12-13
4	What is the function of VOR equipment? <i>Answer – Navigation</i>	JSAT 12-14
5	Name the components of a typical airborne VOR navigation system. <i>Answer – A receiver, antennas, frequency selector and a visual display indicator.</i>	JSAT 12-16
6	What does DME stand for? <i>Answer – Distance Measuring Equipment</i>	JSAT 12-16
7	At what interval must an ATC transponder system be certified? <i>Answer – Every 24 calendar months.</i>	JSAT 12-22
8	Why are two antennas usually required for an ILS system? <i>Answer – The localizer and glideslope signals are transmitted on different frequencies.</i>	JSAT 12-23
9	What information does the glideslope beam provide? <i>Answer – Vertical guidance to enable the aircraft to maintain the correct descent angle.</i>	JSAT 12-24
10	What is the power source for an ELT (Emergency Locator Transmitter)? <i>Answer – An internal battery.</i>	JSAT 12-25
11	Describe one method of monitoring the signal output during an ELT test? <i>Answer – Tune a communications receiver to 121.5 MHz.</i>	JSAT 12-25
12	How would you determine if the batteries in an ELT are due for recharge or replacement? <i>Answer – By looking for an expiration date for recharge or replacement on the battery and/or in the aircraft maintenance records.</i>	JSAT 12-25
13	At what time(s) is a test of an installed ELT permitted? <i>Answer – During the first 5 minutes after the hour and for no more than 3 sweeps.</i>	JSAT 12-25
14	Where on the aircraft would you expect to find a DME antenna? <i>Answer – Generally on the bottom of the fuselage in a location that isn't blocked by the wing during turns.</i>	JSAT 12-31

Chapter 12 — Aircraft Avionics Systems

Q #	Question and Answer	Page Reference
15	Describe the shape and location of a transponder antenna. <i>Answer – Either a short blade or a short wire with a ball end located on the bottom of the fuselage.</i>	JSAT 12-31
16	Name the basic components of an autopilot system. <i>Answer – Gyros, servos, a controller, and an amplifier or computer.</i>	JSAT 12-35
17	What are the sensing elements of an autopilot system? <i>Answer – Attitude, directional, and turning gyros, and an altitude sensor.</i>	JSAT 12-37
18	What is the function of the servos in an autopilot system? <i>Answer – The servos actuate the flight controls.</i>	JSAT 12-38
19	What is the purpose of a bonding jumper from a radio shock mount to the airframe? <i>Answer – To provide a low-impedance ground return.</i>	JSAT 12-50
20	Describe the procedure used to route coaxial cable from an antenna to a receiver. <i>Answer – The cable should be supported every 2 feet, bends should be 10 times the cable diameter, and it should be routed separately from other wires.</i>	JSAT 12-56 AC 43.13-1B

Chapter 12 — Aircraft Avionics Systems

Project #	Project Description	Level
1	<p>Project: Locate the operating instructions and inspection procedures for an autopilot system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the operating instructions and inspections procedures for the specified autopilot system.</p>	1
2	<p>Project: List the major components of an autopilot system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will list the major components of an autopilot system.</p>	1
3	<p>Project: Locate communications and navigation antennas on an aircraft.</p> <p>Given: An aircraft and reference material.</p> <p>Performance Standard: The applicant will point out and name the communications and navigation antennas.</p>	2
4	<p>Project: Check the operation of VHF communications equipment.</p> <p>Given: An aircraft and reference material.</p> <p>Performance Standard: The applicant will use a VHF radio and contact a tower, Flight Service Station, or other radio station for a radio check. Reference material will be used as a guide, and Federal Communications Commission rules will be followed.</p>	3
5	<p>Project: Inspect a coaxial cable installation.</p> <p>Given: An aircraft and reference material.</p> <p>Performance Standard: The applicant will inspect a coaxial cable installation from the antenna to the receiver.</p>	3
6	<p>Project: Test an Emergency Locator Transmitter.</p> <p>Given: An aircraft with an ELT and reference material.</p> <p>Performance Standard: The applicant will test the ELT operation by receiving the signal on a VHF communications radio.</p>	3
7	<p>Project: Inspect the batteries in an ELT.</p> <p>Given: An ELT and reference material.</p> <p>Performance Standard: The applicant will inspect the batteries and determine the replacement or recharge date.</p>	2
8	<p>Project: Inspect the shock mounting base for a piece of electronic equipment.</p> <p>Given: An aircraft and reference material.</p> <p>Performance Standard: The applicant will remove the designated equipment from a shock mounted base, inspect the base, and reinstall the equipment.</p>	3
9	<p>Project: Inspect the bonding jumpers for an electronic equipment shock mounting base.</p> <p>Given: An aircraft, a multimeter, and reference material.</p> <p>Performance Standard: The applicant will inspect the bonding jumper for condition and measure the resistance.</p>	3

Chapter 12 — Aircraft Avionics Systems

Project #	Project Description	Level
10	<p>Project: Inspect static discharge wicks.</p> <p>Given: An aircraft with static discharge wicks, a multimeter, and reference material.</p> <p>Performance Standard: The applicant will inspect the static discharge wicks for security and measure their resistance.</p>	3
11	<p>Project: Inspect a radio installation.</p> <p>Given: An aircraft with installed radio(s) and reference material.</p> <p>Performance Standard: The applicant will inspect the radio installation.</p>	3
12	<p>Project: Inspect an ADF navigation radio installation.</p> <p>Given: An aircraft with an ADF receiver and reference material.</p> <p>Performance Standard: The applicant will inspect the installation of the ADF equipment.</p>	3
13	<p>Project: Locate the operational check procedures for an ADF.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the operational check procedures in the manufacturer's maintenance manual.</p>	1
14	<p>Project: Locate the operating procedures for an airborne weather radar.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the operating procedures in the aircraft maintenance manual or the manufacturer's maintenance manual.</p>	1
15	<p>Project: Inspect a transponder transmission line.</p> <p>Given: An aircraft with a transponder and reference material.</p> <p>Performance Standard: The applicant will inspect the coaxial cable connecting the transponder to its antenna.</p>	3
16	<p>Project: Locate the installation procedures for antennas, including mounting and coaxial cable connections.</p> <p>Given: An aircraft with at least two different antennas and reference material.</p> <p>Performance Standard: The applicant will locate the appropriate installation procedures for each assigned antenna.</p>	1
17	<p>Project: Prepare a list of the required placards for both communications and navigation equipment.</p> <p>Given: An aircraft with communications and navigation equipment installed and reference material.</p> <p>Performance Standard: The applicant will list the required placards and determine if the aircraft meets the requirements of the Type Certificate Data Sheet, Note 2, and the flight manual.</p>	2
18	<p>Project: List the communications and navigation equipment installed in an aircraft and compare it with the aircraft's equipment list.</p> <p>Given: An aircraft with an equipment list.</p> <p>Performance Standard: The applicant will prepare a list of the communications and navigation equipment as installed, compare this list with the aircraft equipment list, and note any discrepancies.</p>	2

Chapter 13 — Airframe Ice and Rain Control

Q #	Question and Answer	Page Reference
1	What controls the temperature in a thermal anti-icing system? <i>Answer — Hot and cold air are mixed.</i>	JSAT 13-3
2	What are the sources of heat for thermal anti-icing systems? <i>Answer — Bleed air from the compressor section of a turbine engine, engine exhaust heat exchangers and combustion heaters.</i>	JSAT 13-3
3	What prevents overheating of the leading edges of a thermal anti-ice system operated by engine bleed air? <i>Answer — Overheat sensors signal the anti-icing valves to close and shut off the hot air.</i>	JSAT 13-4
4	What happens to the hot air used by a thermal anti-ice system after it has heated the surface? <i>Answer — The air is dumped (exhausted) overboard.</i>	JSAT 13-4
5	Why is it necessary to provide overheat protection for anti-icing systems that use turbine engine bleed air? <i>Answer — The air is hot enough to cause damage to the aircraft structure.</i>	JSAT 13-4
6	What are the effects of arcing on an electrically heated windshield? <i>Answer — Localized overheating and damage to the windshield.</i>	JSAT 13-6
7	Can the operation of an electrically heated pitot-tube be checked with the aircraft's ammeter, and if so, how? <i>Answer — Yes, turn the pitot heater on and observe the deflection of the ammeter needle.</i>	JSAT 13-6
8	Describe several potential problems associated with electrically heated windshields. <i>Answer — Arcing, delamination, scratches, and discoloration.</i>	JSAT 13-6
9	Why do some pneumatic deicer boot systems have an electrically operated timer? <i>Answer — To automatically cycle the boots, provide the proper rest time, and then recycle the boots.</i>	JSAT 13-8
10	What are the two common methods of inflating pneumatic deicer boots? <i>Answer — Bleed air from a turbine engine or the exhaust from an engine-driven vacuum pump.</i>	JSAT 13-8
11	What procedure is used to hold deicer boots flat with the airfoil surface during flight? <i>Answer — Suction is applied to the boots.</i>	JSAT 13-8
12	Why do some deicer boot systems incorporate an oil separator? <i>Answer — If a wet pump system is used, the oil must be removed before it reaches the boots because oil damages the rubber.</i>	JSAT 13-9
13	What methods are used to attach a deicer boot to the leading edges of the wing and tail surfaces? <i>Answer — Adhesives, fairing strips and screws, or a combination of both.</i>	JSAT 13-12

Chapter 13 — Airframe Ice and Rain Control

Q #	Question and Answer	Page Reference
14	What important step should be taken prior to making a cold-patch repair to a deicer boot? <i>Answer — Consult the manufacturer's service manual and follow the repair instructions explicitly.</i>	JSAT 13-12
15	Describe the methods commonly used to remove rain from a windshield. <i>Answer — Windshield wipers, a blast of air, or chemical rain repellant.</i>	JSAT 13-16
16	What power sources are used to operate windshield wipers? <i>Answer — Electricity or hydraulic pressure.</i>	JSAT 13-16
17	Name two problems associated with in-flight operation of aircraft windshield wipers. <i>Answer — Insufficient blade pressure caused by aerodynamic forces and failure to oscillate fast enough.</i>	JSAT 13-16
18	Describe the operation of a pneumatic rain removal system. <i>Answer — A high velocity air blast prevents the rain from reaching the surface of the windshield.</i>	JSAT 13-18
19	What are the effects of spraying rain repellant on a dry windshield? <i>Answer — It smears and streaks, which reduces visibility, and it is hard to remove when dry.</i>	JSAT 13-18
20	Where would you find information on the acceptable limits of windshield delamination? <i>Answer — In reference material provided by the manufacturer.</i>	JSAT 14-12

Chapter 13 — Airframe Ice and Rain Control

Project #	Project Description	Level
1	<p>Project: Inspect a pneumatic deicer boot.</p> <p>Given: An aircraft or mockup with a pneumatic deicer boot system and reference material.</p> <p>Performance Standard: The applicant will perform a visual inspection of the deicer boot.</p>	3
2	<p>Project: Perform an operational check of a pneumatic deicer boot system and determine the sequence and cycle timing.</p> <p>Given: An aircraft or mockup with a pneumatic deicer boot system and reference material.</p> <p>Performance Standard: The applicant will use the reference material and operate the system to determine the sequence and timing.</p>	3
3	<p>Project: Troubleshoot and/or repair a pneumatic deicer boot.</p> <p>Given: An aircraft or mockup with a damaged pneumatic deicer boot system, actual or simulated pilot reports, patching equipment, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports, determine the cause of the malfunction and/or patch the damaged boot.</p>	3
4	<p>Project: Perform an operational check of an electrically heated pitot tube.</p> <p>Given: An aircraft or mockup with an electrically heated pitot tube and reference material.</p> <p>Performance Standard: The applicant will check the pitot tube system.</p>	3
5	<p>Project: Troubleshoot an electrically heated pitot tube.</p> <p>Given: An aircraft or mockup with an electrically heated pitot tube, actual or simulated pilot reports, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
6	<p>Project: Troubleshoot and/or perform an operational check of an electrically heated water drain system.</p> <p>Given: A water drain system, actual or simulated pilot reports, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction and/or check the system for proper operation.</p>	3
7	<p>Project: Inspect a thermal anti-ice system.</p> <p>Given: An aircraft thermal anti-ice system and reference material.</p> <p>Performance Standard: The applicant will inspect the system.</p>	3
8	<p>Project: Troubleshoot a thermal anti-ice system.</p> <p>Given: An aircraft thermal anti-ice system and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3

Chapter 13 — Airframe Ice and Rain Control

Project #	Project Description	Level
9	<p>Project: Inspect and/or perform an operational check of an electrically heated wind shield.</p> <p>Given: An aircraft or mockup with an electrically heated windshield and reference material.</p> <p>Performance Standard: The applicant will inspect and/or check the operation of the windshield heat system as assigned.</p>	3
10	<p>Project: Inspect an electrically operated windshield wiper system.</p> <p>Given: A windshield wiper system and reference material.</p> <p>Performance Standard: The applicant will inspect the system and determine its condition and operation.</p>	3
11	<p>Project: Check a hydraulically operated windshield wiper system.</p> <p>Given: A hydraulically operated windshield wiper system and reference material.</p> <p>Performance Standard: The applicant will check the operation of the system.</p>	2
12	<p>Project: Repair a windshield wiper system.</p> <p>Given: A windshield wiper system with improper blade tension, tools, and reference material.</p> <p>Performance Standard: The applicant will adjust the blade tension.</p>	3
13	<p>Project: Troubleshoot an electrically operated or a hydraulically operated windshield wiper system.</p> <p>Given: Actual or simulated pilot reports, a windshield wiper system, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
14	<p>Project: Troubleshoot a pneumatic rain removal system.</p> <p>Given: Actual or simulated pilot reports and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
15	<p>Project: Troubleshoot a rain repellant system.</p> <p>Given: Actual or simulated pilot reports and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction</p>	3
16	<p>Project: Service a rain repellant system.</p> <p>Given: An aircraft or mockup with a rain repellant system, tools, and reference material.</p> <p>Performance Standard: The applicant will remove an empty disposable rain repellant can and replace it with a serviceable pressurized can.</p>	2

Chapter 14 — Cabin Atmosphere Control Systems

Q #	Question and Answer	Page Reference
1	Is there any special requirement as to the type of oxygen used in an aircraft system, and if so, what is it? <i>Answer – Only aviator's breathing oxygen should be used.</i>	JSAT 14-8
2	Describe the operating principle of a continuous-flow oxygen system. <i>Answer – High-pressure oxygen flows from the storage cylinder to a pressure regulator where its pressure is reduced and then to the mask outlets whenever the system is turned on.</i>	JSAT 14-9
3	Describe the operating principle of a pressure-demand oxygen system. <i>Answer – Demand systems allow oxygen to flow from the cylinder to the regulator and then to the mask only when the user inhales. Pressure-demand systems provide oxygen to the mask at higher than atmospheric pressure when used at extremely high altitudes, forcing oxygen into the user's lungs.</i>	JSAT 14-10
4	What should be used to purge an oxygen system of moisture? <i>Answer – Oxygen, dry air, or dry nitrogen.</i>	JSAT 14-17
5	What action must be taken when an oxygen system has been open to the atmosphere? <i>Answer – The system must be purged of any moisture.</i>	JSAT 14-18
6	Describe the safety precautions that should be observed when servicing oxygen systems. <i>Answer – Avoid all contact with petroleum-based oil or grease, don't smoke, keep everything very clean, service systems outdoors if at all possible, and keep the caps on the bottles to protect the valves.</i>	JSAT 14-19
7	What is a Roots blower? <i>Answer – A type of engine-driven compressor.</i>	JSAT 14-20
8	Name two different types of independent cabin air compressors? <i>Answer – Positive-displacement and centrifugal.</i>	JSAT 14-20
9	What is the source of pressurization air in most jet aircraft? <i>Answer – Engine bleed air.</i>	JSAT 14-21
10	What device provides the principle means of controlling cabin pressure? <i>Answer – The outflow valve.</i>	JSAT 14-22
11	What unit regulates the position of an outflow valve? <i>Answer – The cabin pressure controller.</i>	JSAT 14-23
12	Name several methods used on reciprocating-engine aircraft for providing heated cabin air. <i>Answer – Exhaust shroud heat exchangers, combustion heaters, and electric heaters.</i>	JSAT 14-27
13	What is the function of the ventilating air in a combustion heater? <i>Answer – Ventilating air transports the heat from the heater into the cabin and prevents combustion gases from entering the cabin if the combustion chamber develops a crack.</i>	JSAT 14-30

Chapter 14 — Cabin Atmosphere Control Systems

Q #	Question and Answer	Page Reference
14	<p>What are the sources of ventilating air in a combustion heater?</p> <p><i>Answer – Ram air in flight, a blower on the ground, or possibly a compressor if the airplane is pressurized.</i></p>	JSAT 14-30
15	<p>Name the basic components of an air-cycle cooling system.</p> <p><i>Answer – The compressor and expansion turbine, heat exchangers, and various valves.</i></p>	JSAT 14-30
16	<p>Describe the basic operating principles that allow an air-cycle system to produce cool air.</p> <p><i>Answer – Hot engine bleed air is cooled in the primary heat exchanger, compressed, then cooled again in the secondary heat exchanger. This air is expanded across the turbine where energy is extracted and the pressure is reduced. This produces a large temperature drop.</i></p>	JSAT 14-32
17	<p>Describe the basic operating principles of a water separator.</p> <p><i>Answer – Cool, moist air is swirled so that water droplets are separated by centrifugal force, captured by a sock, and drained.</i></p>	JSAT 14-32
18	<p>Name the principle components of a vapor-cycle system.</p> <p><i>Answer – A compressor, condenser, expansion valve, and an evaporator.</i></p>	JSAT 14-33
19	<p>In what significant way is a vapor-cycle cooling system different from an air-cycle system?</p> <p><i>Answer – Vapor-cycle systems use a refrigerant liquid, usually Freon.</i></p>	JSAT 14-33
20	<p>Why is oil added to the refrigerant in a vapor-cycle air conditioning system?</p> <p><i>Answer – To lubricate the compressor</i></p>	JSAT 14-45

Chapter 14 — Cabin Atmosphere Control Systems

Project #	Project Description	Level
1	<p>Project: Troubleshoot a combustion heater and determine why it fails to operate.</p> <p>Given: A combustion heater system or mockup, actual or simulated pilot reports, necessary equipment, and reference material.</p> <p>Performance Standard: The applicant will determine the reason(s) that the heater fails to operate.</p>	3
2	<p>Project: Locate the sources of contamination of a Freon system and the procedures for protecting such a system from contamination during the replacement of a component.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the sources of contamination and the means to prevent contamination during component replacement.</p>	1
3	<p>Project: Locate the procedures for inspecting the fuel system of a combustion heater for leaks.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the inspection procedures.</p>	1
4	<p>Project: Locate the components of a vapor-cycle system in relation to each other.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the components in relation to each other.</p>	2
5	<p>Project: Locate the servicing procedures for a vapor-cycle system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the servicing procedures for the specified system.</p>	1
6	<p>Project: Locate the inspection requirements for a cabin heater using an exhaust shroud heat exchanger as a source of hot air.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the inspection requirements for the specified system.</p>	1
7	<p>Project: Locate the inspection procedures for an outflow valve in a cabin pressurization system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the inspection procedures for an outflow valve.</p>	1
8	<p>Project: Locate the operating instructions for a vapor-cycle system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the operating instructions for the specified system.</p>	1

Chapter 14 — Cabin Atmosphere Control Systems

Project #	Project Description	Level
9	<p>Project: Find the location of the negative pressure relief valve(s) on a pressurized aircraft.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will determine the location of the negative pressure relief valve(s) on the specified aircraft.</p>	2
10	<p>Project: Inspect an oxygen system for leaks.</p> <p>Given: An aircraft or mockup oxygen system, necessary equipment, and reference material.</p> <p>Performance Standard: The applicant will inspect the system using proper procedures and determine if there are any leaks.</p>	3
11	<p>Project: Inspect an oxygen system.</p> <p>Given: An aircraft or mockup oxygen system, necessary equipment, and reference material.</p> <p>Performance Standard: The applicant will inspect the system in accordance with the reference material.</p>	3
12	<p>Project: Service an oxygen system.</p> <p>Given: An aircraft or mockup oxygen system, necessary equipment, and reference material.</p> <p>Performance Standard: The applicant will inspect the system in accordance with the reference material.</p>	3
13	<p>Project: Purge an oxygen system.</p> <p>Given: An aircraft or mockup oxygen system, necessary equipment, and reference material.</p> <p>Performance Standard: The applicant will purge the system.</p>	3
14	<p>Project: Troubleshoot an oxygen system.</p> <p>Given: Actual or simulated pilot reports, an oxygen system, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
15	<p>Project: Troubleshoot a pressurization system.</p> <p>Given: Actual or simulated pilot reports, an oxygen system, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3

Chapter 15 — Aircraft Fuel Systems

Q #	Question and Answer	Page Reference
1	<p>Why do some aircraft have fuel jettison systems?</p> <p><i>Answer – To allow the crew to reduce the weight of the aircraft down to or below the maximum allowable landing weight.</i></p>	JSAT 15-9
2	<p>Is there any reason why a fuel jettison system might be required on a small aircraft?</p> <p><i>Answer – Yes, if the maximum takeoff weight exceeds the maximum allowable landing weight, a jettison system would be required.</i></p>	JSAT 15-9
3	<p>What are some other names for a single-point fueling system?</p> <p><i>Answer – An underwing or pressure fueling system.</i></p>	JSAT 15-14
4	<p>Why do multi-engine airplanes have fuel crossfeed systems?</p> <p><i>Answer – To allow any engine to draw fuel from any tank.</i></p>	JSAT 15-15
5	<p>The fuel selector valve for a multi-engine aircraft must have at least three positions. What are they?</p> <p><i>Answer – ON, OFF, and Crossfeed.</i></p>	JSAT 15-15
6	<p>Why do some fuel tanks have internal baffles?</p> <p><i>Answer – To resist fuel surging or sloshing caused by changes in the attitude of the aircraft.</i></p>	JSAT 15-18
7	<p>What are the two types of fuel cells?</p> <p><i>Answer – Integral or wet wing fuel cells, and bladder-type fuel cells.</i></p>	JSAT 15-19
8	<p>What does the term “wet wing” mean?</p> <p><i>Answer – It means that sealed portions of the aircraft wing structure form the fuel tank(s).</i></p>	JSAT 15-19
9	<p>How is the weight of the fuel supported when bladder-type fuel cells are used?</p> <p><i>Answer – The bladder is supported by the aircraft structure which contains it.</i></p>	JSAT 15-20
10	<p>Why do turbine-engine aircraft have fuel temperature indicating systems?</p> <p><i>Answer – To allow the crew to determine if the fuel is cold enough to produce a danger of the formation of ice crystals.</i></p>	JSAT 15-28
11	<p>Name four types of fuel quantity gauging systems currently in use.</p> <p><i>Answer – Sight gauges, mechanical, electric, and electronic gauges.</i></p>	JSAT15-28
12	<p>Why are electronic (capacitance-type) fuel quantity indicating systems more accurate than other types?</p> <p><i>Answer – They measure the mass of the fuel instead of the volume.</i></p>	JSAT 15-29
13	<p>What are drip gauges and sight gauges?</p> <p><i>Answer – Underwing, bayonet-type fuel gauges.</i></p>	JSAT 15-30

Chapter 15 — Aircraft Fuel Systems

Q #	Question and Answer	Page Reference
14	<p>What is the purpose of an in-transit light associated with an electrically operated fuel tank shutoff valve?</p> <p><i>Answer – To provide an indication that the valve is in motion between one position and another.</i></p>	JSAT 15-31
15	<p>For what reason is a fuel jettison system usually divided into two separate, independent systems, one for each wing?</p> <p><i>Answer – To help maintain lateral stability by jettisoning fuel from a heavy wing if necessary.</i></p>	JSAT15-32
16	<p>What procedures should be followed regarding gaskets and seals when replacing fuel system components?</p> <p><i>Answer – All old gaskets and seals should be replaced with new ones.</i></p>	JSAT 15-33
17	<p>Is it possible for a fuel system to develop a leak that has no visible evidence such as a stain or spot, and if so, how?</p> <p><i>Answer – An internal component such as a valve could develop a leak.</i></p>	JSAT 15-34
18	<p>How is a fuel tank checked for leaks following a patch or welded repair?</p> <p><i>Answer – The tank is slightly pressurized with air and the repaired area is leak-checked with a soap and water solution.</i></p>	JSAT 15-34
19.	<p>Name some advantages of a single-point fueling system.</p> <p><i>Answer – It reduces fueling time, reduces chances for contamination and fire, and eliminates damage to the aircraft skin.</i></p>	JSAT 15-39
20.	<p>Why should you wait for a period of time after fueling an aircraft before checking the fuel sumps?</p> <p><i>Answer – To allow time for water and contaminants to settle to the drain point.</i></p>	JSGT 13-32

Chapter 15 — Aircraft Fuel Systems

Project #	Project Description	Level
1	<p>Project: Inspect a metal fuel tank or a bladder-type fuel tank.</p> <p>Given: A metal fuel tank and reference material.</p> <p>Performance Standard: The applicant will inspect each type of tank and list any defects found.</p>	3
2	<p>Project: Inspect an integral fuel tank.</p> <p>Given: An aircraft with an integral fuel tank and reference material.</p> <p>Performance Standard: The applicant will inspect an integral fuel tank and list any defects found.</p>	3
3	<p>Project: Check manually operated fuel valves.</p> <p>Given: An aircraft with manually operated fuel valves and reference material.</p> <p>Performance Standard: The applicant will operate a fuel valve and determine if it is functioning correctly.</p>	3
4	<p>Project: Troubleshoot a fuel valve.</p> <p>Given: Actual or simulated pilot reports, a fuel valve system, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
5	<p>Project: Drain the sumps on a fuel system.</p> <p>Given: An aircraft and reference material.</p> <p>Performance Standard: The applicant will locate each sump, drain fuel from each sump, and determine if the fuel is contaminated with water.</p>	3
6	<p>Project: Inspect a metal fuel tank or a bladder-type fuel tank.</p> <p>Given: A metal fuel tank and reference material.</p> <p>Performance Standard: The applicant will inspect each type of tank and list any defects found.</p>	3
7	<p>Project: Service a fuel system strainer.</p> <p>Given: An aircraft with a fuel system strainer, tools, and reference material.</p> <p>Performance Standard: The applicant will remove, clean, and install a fuel system filter.</p>	3
8	<p>Project: Calibrate a direct reading fuel quantity indicating system.</p> <p>Given: An aircraft with a fuel system requiring calibration, tools, and reference material.</p> <p>Performance Standard: The applicant will calibrate the direct reading fuel system in accordance with appropriate instructions.</p>	3
9	<p>Project: Inspect a remote reading fuel quantity indicating system.</p> <p>Given: An aircraft with a remote indicating system and reference material.</p> <p>Performance Standard: The applicant will inspect a remote indicating system.</p>	3
10	<p>Project: Locate the operating instructions and inspection procedures for a fuel system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the operating instructions and inspection procedures for the specified system.</p>	1

Chapter 15 — Aircraft Fuel Systems

Project #	Project Description	Level
11	<p>Project: Locate the required placards for a fuel system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the required placards.</p>	1
12	<p>Project: Locate the crossfeed procedures for the fuel system in a multi-engine aircraft.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the fuel system crossfeed procedures.</p>	1
13	<p>Project: Locate the fueling and defueling procedures for a fuel system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the fueling and defueling procedures for the specified system.</p>	1
14	<p>Project: Troubleshoot a fuel pressure warning system.</p> <p>Given: Actual or simulated pilot reports, a fuel pressure warning system, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
15	<p>Project: Troubleshoot a fuel temperature system.</p> <p>Given: Actual or simulated pilot reports, a fuel temperature system, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
16	<p>Project: Replace a fuel quantity transmitter.</p> <p>Given: A fuel tank, fuel quantity transmitter, gasket material, tools, and reference material.</p> <p>Performance Standard: The applicant will replace the transmitter and perform a functional check of the unit.</p>	3
17	<p>Project: Troubleshoot an aircraft fuel system.</p> <p>Given: Actual or simulated pilot reports, an aircraft fuel system, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
18	<p>Project: Remove and install a fuel tank valve.</p> <p>Given: An aircraft, tools, and reference material.</p> <p>Performance Standard: The applicant will remove, install, and adjust the rigging of a fuel system valve.</p>	3
19	<p>Project: Troubleshoot a fuel system with an internal leak.</p> <p>Given: A fuel system with a internal leak, actual or simulated pilot reports, tools, and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports, operate the system, and identify the leaking units.</p>	3

Chapter 16 — Fire Protection Systems

Q #	Question and Answer	Page Reference
1	Briefly describe the components of a thermal switch fire detection system. <i>Answer — Temperature sensitive switches that complete a circuit at a specific temperature and trigger a warning.</i>	JSAT 16-4
2	Are thermal switches wired in series or in parallel with each other? <i>Answer — Parallel</i>	JSAT 16-5
3	How are the detector units in a double-loop Fenwal system wired? <i>Answer — In parallel between two complete loops of wiring.</i>	JSAT 16-5
4	In what way is a thermocouple fire warning system different from a thermal switch system? <i>Answer — Thermocouple systems are sensitive to the rate of temperature change, whereas thermal switch systems respond to a specific temperature value.</i>	JSAT 16-6
5	Briefly describe the components of a Kidde continuous loop fire detection system. <i>Answer — A Kidde system has an inconel tube containing one or more wires embedded in a ceramic core whose resistance changes with temperature.</i>	JSAT 16-8
6	Briefly describe the components and operation of a Lindberg fire detection system. <i>Answer — A stainless steel tube contains an inert gas and a discrete material that absorbs some of the gas. When the tube heats up, some gas is released, raising the pressure in the tube, which activates a pressure switch.</i>	JSAT 16-8
7	Describe the process or mechanism by which a photoelectric smoke detector generates a warning of a possible fire. <i>Answer — Smoke particles refract light in the detector unit causing the photoelectric cell to conduct electricity and trigger the alarm.</i>	JSAT 16-11
8	How can the operation of a photoelectric smoke detector be tested? <i>Answer — By actuating a test switch.</i>	JSAT 16-11
9.	Name two types of smoke detection systems used in aircraft. <i>Answer — Light refraction (photoelectric) types and ionization types.</i>	JSAT 16-11
10	What are the usual locations where a carbon monoxide detector would be installed? <i>Answer — In an aircraft cockpit or cabin.</i>	JSAT 16-12
11	How does a carbon monoxide detector indicate the presence of this deadly gas? <i>Answer — The tan spot on the detector turns gray or black.</i>	JSAT 16-12
12	What are the possible effects of kinks and sharp bends in the sensing element(s) of a fire warning system? <i>Answer — False fire warnings caused by short circuits.</i>	JSAT 16-15
13	How is a Freon container checked for proper pressure? <i>Answer — A chart must be used to determine the maximum and minimum gauge pressure readings based on the ambient temperature.</i>	JSAT 16-16 16-22

Chapter 16 — Fire Protection Systems

Q #	Question and Answer	Page Reference
14	Name the two basic types of fire extinguishing systems. <i>Answer — The conventional system and the high-rate discharge system.</i>	JSAT 16-18
15	Name the extinguishing agent most commonly used by conventional fire extinguishing systems. <i>Answer — Carbon dioxide (CO₂)</i>	JSAT 16-19
16	Name the extinguishing agent most commonly used by high-rate discharge fire extinguishing systems. <i>Answer — Halon (Halogenated hydrocarbon type agents), also known as Freon.</i>	JSAT 16-20
17	How are Freon bottles protected from excessively high temperatures and how can you tell that this has occurred? <i>Answer — A thermal fuse (or blowout disk) will release the agent if the bottle temperature exceeds a certain limit. This blows out a red indicator disk.</i>	JSAT 16-20
18	What condition is indicated if the yellow disk is missing in a fire extinguishing system? <i>Answer — The system has been discharged normally.</i>	JSAT 16-20
19	Describe the mechanism by which a Freon bottle is discharged. <i>Answer — An electrical signal fires an explosive squib, which ruptures a frangible disk.</i>	JSAT 16-20
20	How is the service life of a discharge cartridge calculated? <i>Answer — From the date stamped on the cartridge by the manufacturer.</i>	JSAT 16-22

Chapter 16 — Fire Protection Systems

Project #	Project Description	Level
1	<p>Project: Locate the procedures for inspecting a carbon monoxide detector.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the inspection procedures for a carbon monoxide detector.</p>	1
2.	<p>Project: Locate the procedures for checking a smoke detector system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the procedures for checking a smoke detector system.</p>	1
3	<p>Project: Locate the inspection procedures for a thermal switch type fire detection system.</p> <p>Given: Reference material.</p> <p>Performance Standard: The applicant will locate the inspection procedures for the assigned system.</p>	1
4	<p>Project: Inspect a thermal switch fire detection system.</p> <p>Given: An aircraft or mockup with a thermal switch fire detection system and reference material.</p> <p>Performance Standard: The applicant will locate all the components in the system and check the system for proper operation.</p>	3
5	<p>Project: Check a thermal switch fire detection system.</p> <p>Given: An aircraft or mockup with a thermal switch fire detection system, test equipment, and reference material.</p> <p>Performance Standard: The applicant will check the operation of each thermal switch and indicator light.</p>	2
6	<p>Project: Troubleshoot a thermal switch fire detection system.</p> <p>Given: Actual or simulated pilot reports and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
7	<p>Project: Repair a thermal switch fire detection system.</p> <p>Given: An aircraft or mockup containing a thermal switch fire detection system with a fault, tools, test equipment, and reference material.</p> <p>Performance Standard: The applicant will locate the fault and repair the system.</p>	3
8	<p>Project: Inspect a thermocouple fire warning system.</p> <p>Given: An aircraft or mockup with a thermocouple fire warning system and reference material.</p> <p>Performance Standard: The applicant will locate all the components in the system and check the system for proper operation.</p>	3

Chapter 16 — Fire Protection Systems

Project #	Project Description	Level
9	<p>Project: Troubleshoot a thermocouple fire warning system.</p> <p>Given: Actual or simulated pilot reports and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
10	<p>Project: Check a continuous loop fire detection system.</p> <p>Given: An aircraft or mockup with a continuous loop fire detection system and reference material.</p> <p>Performance Standard: The applicant will determine and use the appropriate procedures to check the system.</p>	3
11	<p>Project: Troubleshoot a continuous loop fire detection system.</p> <p>Given: Actual or simulated pilot reports and reference material.</p> <p>Performance Standard: The applicant will analyze the pilot reports and determine the cause of the malfunction.</p>	3
12	<p>Project: Inspect the CO2 storage containers in a fire protection system.</p> <p>Given: An aircraft or mockup with a fire protection system using CO2 storage containers and reference material.</p> <p>Performance Standard: The applicant will inspect the CO2 storage containers and determine the date of last weighing, condition of the discharge indicators, and security of the system components.</p>	3
13	<p>Project: Inspect and/or troubleshoot a conventional CO2 fire protection system.</p> <p>Given: An aircraft or mockup with a conventional CO2 fire protection system, actual or simulated pilot reports, and reference material.</p> <p>Performance Standard: The applicant will inspect the system components for security and condition and/or analyze the pilot reports and determine the cause of the malfunction as assigned.</p>	3
14	<p>Project: Inspect a fire protection system Freon bottle for charge pressure.</p> <p>Given: An aircraft with a Freon-type fire extinguishing system and reference material.</p> <p>Performance Standard: The applicant will inspect the Freon bottle pressure using an appropriate chart with temperature and pressure curves.</p>	3
15	<p>Project: Inspect and/or troubleshoot a high-rate discharge fire protection system.</p> <p>Given: An aircraft or mockup with a high-rate discharge fire protection system, actual or simulated pilot reports, and reference material.</p> <p>Performance Standard: The applicant will inspect the system components for security and condition and/or analyze the pilot reports and determine the cause of the malfunction as assigned.</p>	3

Chapter 16 — Fire Protection Systems

Project #	Project Description	Level
16	<p>Project: Inspect a Freon bottle discharge cartridge.</p> <p>Given: A Freon bottle with a discharge cartridge, tools, and reference material.</p> <p>Performance Standard: The applicant will inspect the discharge cartridge and record the manufacturer's date stamp.</p>	3
17	<p>Project: Check the discharge circuit of a Freon bottle.</p> <p>Given: An aircraft or mockup with a Freon fire extinguishing system, tools, and reference material.</p> <p>Performance Standard: The applicant will remove the electrical connector from each discharge cartridge and check the continuity of the firing circuit between the switch and the cartridge.</p>	3
18	<p>Project: Inspect a fire extinguisher bottle or cylinder and determine the hydrostatic test date.</p> <p>Given: A portable or fixed fire extinguisher bottle or cylinder and reference material.</p> <p>Performance Standard: The applicant will determine the date at which the next hydrostatic test is due.</p>	2

NOTES

Chapter 17 — Aircraft Airworthiness Inspection

Q #	Question and Answer	Page Reference
1	Where do you find the regulation that specifies the operating conditions that make 100-hour inspections mandatory? <i>Answer – FAR Part 91</i>	JSAT 17-1
2	A certificated Airframe & Powerplant mechanic may sign off and approve the return to service following what type of inspection? <i>Answer – A 100-hour inspection.</i>	JSAT 17-5
3	Under what conditions may a mechanic perform an annual inspection and return the aircraft to service? <i>Answer – The mechanic must hold an Inspection Authorization.</i>	JSAT 17-5
4	What is the time frame within which an annual inspection must be performed if such an inspection is required? <i>Answer – Within the preceding 12 calendar months.</i>	JSAT 17-5
5	Under what conditions may any checklist be used as a guide for a 100-hour inspection? <i>Answer – The checklist must meet the minimum standards specified in FAR Part 43, Appendix D.</i>	JSAT 17-5
6	May an aircraft that is overdue for an annual inspection be flown to a place where the inspection can be performed? <i>Answer – Yes, provided a ferry (special flight) permit is obtained.</i>	JSAT 17-5
7	In order for an individual person to conduct a 100-hour inspection and approve the return to service, that person must have what type of certificate(s)? <i>Answer – A mechanic's certificate with both the Airframe and Powerplant ratings.</i>	JSAT 17-5
8	An aircraft is required by FAR 91.409 to have a 100-hour inspection. Is it legal to fly that airplane beyond the inspection requirement, and if so, for how long? <i>Answer – Yes, the aircraft may be operated for up to 10 hours, if required, to reach a place where the inspection can be accomplished.</i>	JSAT 17-5
9	An airplane is flown 4 hours over the 100-hour inspection limit to reach your maintenance facility. How do you account for those 4 hours? <i>Answer – The 4 hours are included in the next 100 hours time-in-service period.</i>	JSAT 17-5
10	What types of operations require that aircraft operating under Part 91 must undergo 100-hour inspections? <i>Answer – Aircraft operated for compensation or hire, or used for flight instruction when provided by the flight instructor.</i>	JSAT 17-5 FAR part 91.409
11	An aircraft under a progressive inspection program is operated for compensation or hire. Does it need a 100-hour inspection? <i>Answer – No, progressive inspections replace 100-hour inspections.</i>	JSAT 17-7

Chapter 17 — Aircraft Airworthiness Inspection

Q #	Question and Answer	Page Reference
12	Who is authorized to supervise a progressive inspection? <i>Answer – Certificated A & P mechanics who hold an Inspection Authorization, certified repair stations, or the aircraft manufacturer.</i>	JSAT 17-8
13	When a progressive inspection program is discontinued, at what time is the next 100-hour inspection due? <i>Answer – 100 hours after the last complete inspection of the progressive program.</i>	JSAT 17-8
14	An owner desires to use a progressive inspection program. To whom does the owner apply for authorization? <i>Answer – To the FAA Flight Standards District Office having jurisdiction over the area where the owner is located.</i>	JSAT 17-8
15	Is an engine run-up required as part of a 100-hour inspection on a turbine-powered aircraft? <i>Answer – Yes</i>	JSAT 17-33
16	Where would you locate the required items that must be recorded in the aircraft maintenance records following completion of a 100-hour inspection? <i>Answer – FAR Part 43</i>	JSAT 17-43
17	Where might you locate a sample of the recommended statement for recording the approval for return to service of an aircraft following completion of an annual or 100-hour inspection? <i>Answer – FAR Part 43</i>	JSAT 17-43
18	Where would you look to find approved information for work on an aircraft electrical system? <i>Answer – In the manufacturer's maintenance manual or other instructions for continued airworthiness.</i>	JSGT 14-12
19	What are the limitations placed on mechanics with regard to propellers? <i>Answer – Mechanics may not perform major repairs to, or alterations of, propellers.</i>	JSGT 15-3, FAR part 65.81
20	After equipment is installed in accordance with an STC, who must approve the return to service? <i>Answer – An A & P mechanic who holds an Inspection Authorization.</i>	JSGT 15-3

Chapter 17 — Aircraft Airworthiness Inspection

Project #	Project Description	Level
1	<p>Project: Determine compliance with applicable Airworthiness Directives.</p> <p>Given: Aircraft records and published ADs.</p> <p>Performance Standard: The applicant will review the aircraft records and create a list indicating which ADs have been complied with and any ADs not complied with.</p>	2
2	<p>Project: Perform a 100-hour inspection.</p> <p>Given: An aircraft and reference material.</p> <p>Performance Standard: The applicant will perform a 100-hour inspection (some elements may be excluded).</p>	3
3	<p>Project: Record the results of a 100-hour inspection.</p> <p>Given: FAR Part 43</p> <p>Performance Standard: The applicant will create a sample maintenance record entry using the required statement.</p>	2
4	<p>Project: Create a list of discrepancies found during a 100-hour inspection.</p> <p>Given: A list of discrepancies.</p> <p>Performance Standard: The applicant will make a sample list of discrepancies that conforms to the requirements of FAR Part 43.11.</p>	2
5	<p>Project: Inspect an aircraft for conformity.</p> <p>Given: An aircraft and the appropriate Type Certificate Data Sheets.</p> <p>Performance Standard: The applicant will inspect the aircraft and use the Type Certificate Data Sheets to determine if the correct engine and propeller are installed.</p>	3
6	<p>Project: Inspect an aircraft following routine maintenance.</p> <p>Given: An aircraft with completed maintenance and reference material.</p> <p>Performance Standard: The applicant will determine if the completed maintenance has been performed in accordance with the reference material.</p>	3
7	<p>Project: Determine the due date for an annual inspection and the time requirement for 100-hour inspection.</p> <p>Given: Aircraft records.</p> <p>Performance Standard: The applicant will review the aircraft records and indicate the date on which the next annual inspection is due and the time-in-service point at which a 100-hour inspection is due.</p>	2
8	<p>Project: Determine the compliance requirements for an AD that has a repetitive inspection requirement.</p> <p>Given: A specific AD and appropriate aircraft records.</p> <p>Performance Standard: The applicant will review the aircraft records, list the date of completion of the last inspection, and indicate the date on which the next inspection is due.</p>	2

Chapter 17 — Aircraft Airworthiness Inspection

Project #	Project Description	Level
9	<p>Project: Create a checklist for conducting a 100-hour inspection.</p> <p>Given: An aircraft and FAR Part 43.</p> <p>Performance Standard: The applicant will create a checklist, applicable to the given aircraft, that contains the scope and detail specified in FAR Part 43, Appendix D.</p>	2
10	<p>Project: Prepare an aircraft for a 100-hour inspection.</p> <p>Given: An aircraft and reference material.</p> <p>Performance Standard: The applicant will prepare the aircraft for a 100-hour inspection (some elements may be excluded).</p>	2
11	<p>Project: Prepare and install a placard indicating that a piece of equipment is inoperative and make an appropriate entry in the maintenance records.</p> <p>Given: An aircraft and reference material.</p> <p>Performance Standard: The applicant will correctly placard the inoperative equipment and make the appropriate maintenance record entry.</p>	2